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Vol. 20. No. 4 APRIL, 1922

THE METAL INDUSTRY

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THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER
ELECTRO-PLATERS REVIEW

Entered as second class matter February 10, 1903, at the post-office at New York under the Act of 1879.

A MONTHLY PUBLICATION RELATING TO THE METAL AND PLATING TRADES

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Vol. 20 NEW YORK, APRIL, 1922 No. 4

Motion Study in Metal Polishing

Experiment with a Wattmeter on the Process of Roughing

By E. FARMER and R. S. BROOKE

The possibilities of applying motion study methods in the buffing trade have been investigated for the Industrial Fatigue Research Board (of Great Britain) by Mr. E. Farmer, M. A., assisted by Mr. R. S. Brooke, M. A., who have published the results in Report No. 15. In this report they advocate a definite course of training based on the principles indicated therein, for all workers who enter the buffing trade, instead of allowing them to pick up their trade as best they can. Among the problems which require research is that of vibration, and it is suggested that efforts should be made on the technical side to devise an abrasive which is less dusty and dirty than loose sand, and not so coarse as an emery wheel. If sand were replaced by a less objectionable abrasive, the roughers would be saved much discomfort. Seats should be provided for the workers and their benches should be modified in such a way as to permit the use of the seats without discomfort being caused by inadequate space for the legs. In the following extract from the report an experiment is described with a wattmeter on the process of roughing.

The following experiment was made possible by the kindness and generosity of Mr. Julius Frith, M.Sc., M.I.E.E., M.Cons.E., of Manchester, who lent a recording wattmeter for the purpose. This instrument gives a continuous graphic record of the amount of electrical energy expended by the motor in use. The line given on the chart representing the energy expended by the motor in revolving the buffing wheel, when no roughing operation is in progress, will be known as the zero line.

In the roughing process (the process of removing imperfections and scratches from the surface and edges of the metal by means of a wooden wheel covered with a leather tyre and rotating at a high speed) the thrusting of the article against the wheel results in a frictional retardation of the buffing wheel, and the amount of energy expended by the motor to overcome this friction is accurately marked upon the chart. Moreover, from the nature of the process this friction cannot be caused passively—the girl cannot lean the spoon against the wheel—and so the amount of friction caused is directly dependent upon the human effort exerted. Hence the height of the individual strokes above the zero line made by the pen of the wattmeter on the chart can be assumed to correspond to the amount of effort put forth by the rougher.

Since the wattmeter records every stroke of the rougher against the wheel, and also every pause between the strokes, a graph is automatically obtained giving a complete time study of the operation under investigation. Arrangements were made to have this instrument connected with a spindle that had been detached from the shafting driven by the main factory motor. The work of any girl sent to this spindle could thus be isolated and a complete chart of her work during any given period obtained. For this experiment two roughers, workers Nos. 15 and 23, employing very different methods, were selected. No 15 was a very steady worker and was noticeable for the easy rhythmic manner in which she roughed. No. 23 was of an excitable temperament and an unsteady worker. Her methods of roughing were characterized by a violent swaying motion of the body culminating in a heavy thrust of the spoon against the roughing wheel.

Each girl was set to work in turn at the spindle driven by the motor to which the wattmeter had been attached and was observed at her work for two days, during which she was kept supplied with table spoons.

Owing to the great difficulty of reading a chart which records each movement of the worker, no attempt was made to obtain a continuous chart of the whole day's work, but the experiment was confined to getting complete records of the roughing of four spoons at various intervals throughout the day. The following were approximately the hours at which records were obtained:—

8.45 a.m.—This allowed the girl time to "get into her swing." Work having started at 8 a.m.

9.45 a.m.—That is, just before the morning break at 10.

10.45 a.m.—That is, after morning break, allowing the girl time again to get into her swing.

12.15 p.m.—That is, just before dinner hour and, therefore, likely to show evidence of morning fatigue.

2.15 p.m.—That is, after dinner hour. Again allowing time for girl to get into her swing.

3.15 p.m.—That is, just before tea.

4.15 p.m.—That is, after tea allowing time to get into her swing.

5.15 p.m.—That is, just before work finished at 5.30. Likely to show evidence of the total day's fatigue.

During the first day with Worker No. 15 a record was obtained at each of these hours except at 10.45 when, owing to a slight mischance with the wattmeter, no record could be taken.

At 3.15 p.m. on this day an exceptionally fast time was obtained. This was accounted for by the fact that just before the record was taken No. 15 asked the investigator whether she was working satisfactorily and the object of the experiment. He told her, and the result was a great stimulation in her interest resulting in much quicker work. This additional stimulus soon wore off and 5.15 the curve was again normal.

During the second day of Worker No. 15 and the first day of Worker No. 23 the full eight records were obtained in each case. Unfortunately, on the second day of Worker No. 23 the instrument broke after two records had been obtained and the experiment with the wattmeter had to be abandoned:

In analyzing these records detailed examination was confined to the roughing of the backs of the bowls. This particular portion of the spoons was selected, first because the surface is large and the roughing of it is therefore likely to give evidence of any fatigue that may exist, secondly because long heavy strokes are generally applied in roughing it, and thirdly because the work is not complicated by any difficult corners or pattern.

The following method was adopted in examining these charts: First, the total time taken to rough the four bowls and the average time per bowl was ascertained from the wattmeter records. The number of strokes per spoon was counted and each stroke measured, and in this way the average length per stroke in centimeters on each record was obtained. Finally, the time taken on each four bowls was divided by the total number of strokes, thus giving the average duration of each stroke.

TABLE I.—WATTMETER ANALYSIS OF MOVEMENTS OF TWO WORKERS.

Hour of Records	Total Time for 4 Bowls (Sec.)	Average Time Per Bowl (Sec.)	Total Duration of Pauses (Sec.)	Average Number of Strokes Per Bowl	Average Pressure of Each Stroke* (Cm.)	Average Duration of Each Stroke (Sec.)
			Worker No. 15. First Day.			
8.45 a.m.	52.8	11.4	7.2	17¼	2.50	0.65
9.45 "	78	18	6	17	2.09	1.06
10.45 "						
12.15 p.m.	77	17.1	8.5	17¼	2.73	0.99
2.15 "	78.2	16.9	8.6	16½	2.14	1.02
3.15 "	57	12.9	5.4	14¾	2.41	0.87
4.15 "	76.6	15	16.6	16	2.27	0.94
5.15 "	101.2	23.6	6.8	22½	2.27	1.05
			Worker No. 15. Second Day.			
8.45 a.m.	66	15.2	5.2	16½	2.21	0.92
9.45 "	51	11.2	6.4	15½	2.61	0.72
10.45 "	79	15.5	17	16	2.30	0.97
12.15 p.m.	76	16.8	8.8	16½	2.30	1.02
2.15 "	83	19.5	5	18¾	1.99	1.07
3.15 "	74	15.5	12	15¼	2.52	1.02
4.15 "	84	19.2	7.2	17¼	2.44	1.11
5.15 "	101	18.2	28.2	16¼	2.63	1.18
			Worker No. 23.			
8.45 a.m.	89	19	13	15	2.62	1.27
9.45 "	98	22.2	9.2	16½	2.76	1.35
10.45 "	103	21	19	15¾	3.02	1.33
12.15 p.m.	107	21.6	20.6	14¼	2.89	1.52
2.15 "	115	26	11	17¾	2.81	1.47
3.15 "	118	25	18	16½	2.65	1.52
4.15 "	119	27	11	16¾	3.64	1.61
5.15 "	139	31	15	16	3.24	1.94

*As indicated by height of curve on Wattmeter record.

The results are given in Table I, which brings out in a most striking fashion the great difference in the methods of work of these two girls, and the large amount of extra energy that No. 23 put forth. This additional pressure resulted, as has been shown in the report upon roughing, in her removing from 2.4 to 2.8 oz. (troy) of metal from three dozen dessert spoons, whereas No. 15 removed on an average slightly less than 1.8 oz. The work turned out by No. 15 was, however, of excellent quality, and the additional pressure exerted by No. 23 was wasted labour and had the effect of unnecessarily fatiguing her and at the same time wearing out the roughing wheel.

A detailed examination of these tables shows that in all instances the time taken to rough four bowls increases towards the end of the day. In the case of No. 15 this increase was gradual and fluctuating, but in the case of No. 23 it was much greater and is continuous throughout the day. The number of strokes made by each worker was about the same and showed only a slight tendency to increase towards the end of the day. The height of each stroke above the zero line, which is a comparative measure of the pressure exerted in each stroke, showed a marked tendency to increase during the afternoon, but here again this was much more evident in No. 23 than in No. 15. The duration of the stroke also increased during the day in all cases, and the increase was especially marked during the work period in the late afternoon. It is evident from this that both these workers, but especially No. 23, as they grew tired towards the end of the day were inclined to give more vigorous strokes and to take longer over each individual stroke.

Two factors are present which together determine the duration of the stroke, namely, the length of time that the pressure of the spoon against the wheel is sustained and the length of the pause between successive applications of this pressure.

An examination of the charts shows quite clearly that both these factors were in operation, and that towards the end of the day's work both girls made more sustained strokes and also paused longer between strokes.

Another method of measuring the wattmeter records was suggested and kindly carried out by Mr. Frith. A planimeter was used for measuring the areas enclosed by the recording pen of the wattmeter. These measurements give the energy expended by the motor in order to overcome the frictional retardation caused by the worker pressing the spoon against the revolving wheels and so give an approximate measure of the human effort exerted. The areas averaged throughout the day are:—

Worker 23.....2.18 sq. ins.
Worker 15.....1.1 sq. ins.

for the roughing of the bowls of four spoons.

The detailed results of Mr. Frith's measurements, together with his explanatory notes, are given in Table II.

It is unfortunate that the records obtained from worker No. 15 were so blurred that they did not lend themselves readily to measurement by means of the planimeter.

TABLE II.—WATTMETER ANALYSIS OF EFFORT EXPENDED BY TWO WORKERS.

1 Approx. Time of Day	2 Chart Area for 4 Bowls (Sq. In.)	3 No. of Strokes N (4 Bowls)	4 Average Duration (W+R) (Secs.)	5 N(W+R)* (Secs.)	6 Total Time Per 4 Bowls (Secs.)
		Worker No. 23.			
8.45 a.m.	2.0	60	1.30	78	89
9.45 "	2.1	66	1.36	90	98
10.45 "	2.9	63	1.46	92	103
12.15 p.m.	2.5	57	1.37	78	107
2.15 "	2.9	71	1.36	97	115
3.15 "	2.7	66	1.31	87	118
4.15 "	3.9	67	1.49	100	119
5.15 "	3.7	64	1.67	107	139

WORKER No. 15. SECOND DAY.

8.45 a.m.	1.0	60		66
9.45 "	0.7	57		51
10.45 "	1.0	64		79
12.15 p.m.	1.2	66	Charts undecipherable	76
2.15 "	1.1	73		83
3.15 "	0.8	61		74
4.15 "	1.3	69		84
5.15 "	1.1	65		101

EXPLANATION OF TABLE.

Column.

1. Time of day at which readings were taken.
2. Area of wattmeter chart (above 150 line), for work on four bowls. The 150 line was taken as indicating the electrical energy absorbed by motor and machinery running light.
3. The number (N) of **strokes** (see below) in completing four bowls.
4. A **stroke** includes two periods:—
   W. seconds, in which the spoon is held against the buff.
   R. seconds, rest or pause before the next stroke.
   The average lengths of W. and R. were measured from the charts by means of a micro-scale. They were measured along the 190 line, which was chosen arbitrarily for this purpose.
   Column 4 gives the *sum* of average W., and R. or time of a complete stroke.
5. N. multiplied by (W. plus R.) or the time occupied by all the strokes.
6. The over-all time of the operation on four bowls, as recorded by the clock.

The correlation between Mr. Frith's planimeter measurements of effort exerted and the results obtained by the method previously described are as follows:—

In the case of worker No. 23 r = + .86

In the case of worker No. 15 r = — .51

The minus correlation in the case of Worker No. 15, coupled with the fact that the graph on the wattmeter chart was very blurred, seems to suggest that the first method adopted, namely, that of measuring the height of each stroke, is in this case likely to be more satisfactory than measurement of area by a planimeter.

A large margin of error must be allowed in measuring exactly such minute records as those supplied by the wattmeter. This factor of human error which must necessarily enter into the work need not materially affect any theory which is based upon the records, since any such theory must depend on a comparison between measurements in the same series in which the factor of error may be taken as constant.

It has been shown that fewness of strokes corresponds very closely with high output. The natural inference, therefore, was that in getting maximum output, the fewness of the strokes must be compensated for by a greater pressure exerted in each stroke or by an increase in the time during which the article is held against the wheel.

Putting this another way, and using the terminology employed in the charts, fewness of strokes implies increased duration and increased pressure, if good output is to be maintained. When, however, the curves were plotted, as in Fig. I, a marked correspondence is found between shortness of time to perform the operation, fewness of strokes, shortness of duration and lightness of pressure, which if there were no limiting factors would result in an obvious absurdity. Fig. I shows that the curves representing strokes, duration and pressure follow the line of output fairly closely in the morning. The correspondence is still noticeable in the afternoon, though the variations are more marked.

The accounts of earlier experiments carried out in time and motion study have described the large part played by rhythm in the easy performance of most industrial operations and probably rhythm is the determining factor in this case too. In the earlier part of the day when the worker is fresh, the work is done rhythmically and the results are satisfactory. The nearest approach that can be made to instill rhythm is by modifying the number of strokes. It will be seen that the number of strokes per spoon varies little in the morning and that greater variations are introduced in the afternoon, as fatigue increases the natural rhythm of the body seems to break down and conscious effort is invoked in order to do the work.

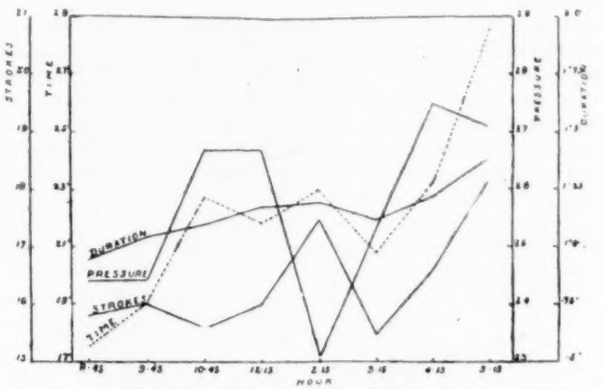


FIG. 1. DURATION, PRESSURE AND STROKES IN ROUGHING FOUR TABLE SPOONS COMPARED WITH TIME REQUIRED

This is shown by the increased effort put into the work, as indicated by increased pressure, duration and number of strokes, but in spite of this effort, or perhaps on account of it, the time required to perform the operation steadily increases. The natural rhythm of the worker seems to have been broken by fatigue, and in order to counteract this the more complicated and lengthy mental processes of volition and conscious effort have been introduced with their natural fatiguing effect.

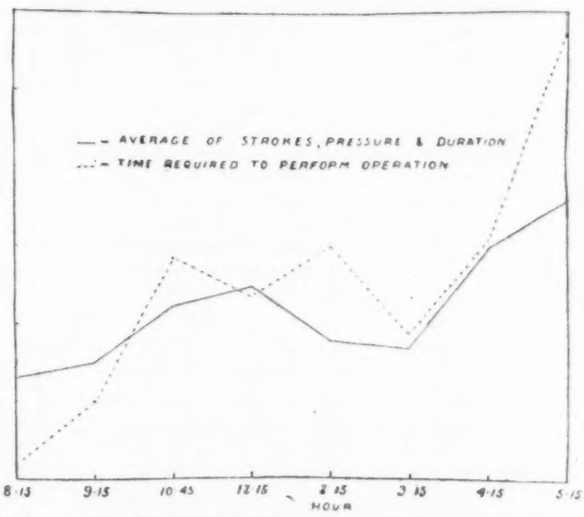


FIG. 2. AVERAGE DURATION, PRESSURE AND STROKES, COMPARED WITH TIME REQUIRED

RISE IN CURVE

The fact that this curve tends to rise as the time to perform the operation rises seems to show that as the worker becomes fatigued the co-ordination between the factors represented by the curve of rhythm becomes more and more disturbed, fatigue having the effect not only of slowing the re-action times as shown in the curve representing duration of strokes, but also causing a certain

lack of motor control resulting in increased pressure and increased number of strokes. The tired worker is, therefore, not only working slower than when she is fresh, but is also expending her energy extravagantly. If this interpretation is right, it would imply that in order to obtain a satisfactory output throughout the day an attempt must be made to retain the even rhythm shown by the workers in the morning, so as to prevent the excess of effort put forth during the afternoon. Attention must be paid to an external standard that the worker must attain, but to the internal mechanism of the nervous and muscular systems.

A parallel will be found in the case of a rowing crew. When the crew is well trained the boat swings along with a natural rhythm which is the result of the combined rhythm of the oarsmen. When the crew is tired there is a tendency for the rowing to become "ragged," which means that the rhythm has been broken. The method of reviving a "ragged" crew is not to get them to put

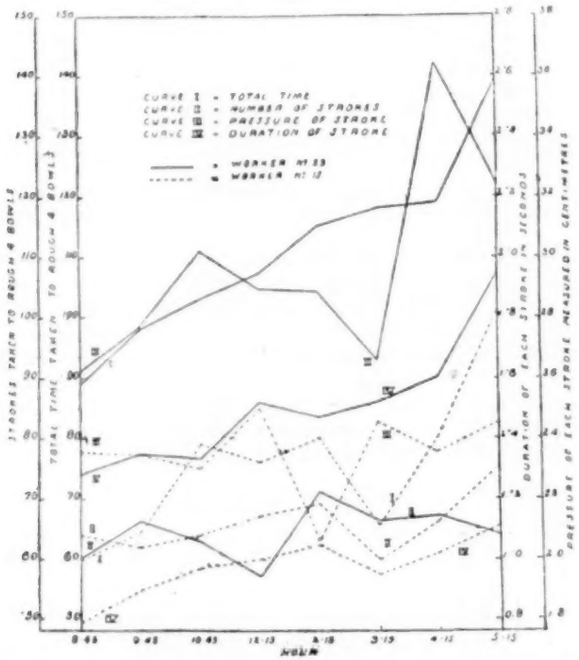

CURVE I = TOTAL TIME
CURVE II = NUMBER OF STROKES
CURVE III = PRESSURE OF STROKE
CURVE IV = DURATION OF STROKE
WORKER NO 23
WORKER NO 15
STROKES TAKEN TO ROUGH 4 BOWLS
TOTAL TIME TAKEN TO ROUGH 4 BOWLS
DURATION OF EACH STROKE IN SECONDS
PRESSURE OF EACH STROKE MEASURED IN CENTIMETRES
HOURS

FIG. 3. PERFORMANCE OF WORKERS 23 AND 15 COMPARED

more effort into their rowing, but to encourage them to "smarten it up," which means getting back to the feeling of rhythm which has been lost.

ELIMINATION OF UNNECESSARY MOVEMENT

If the suggestion put forward is correct, it follows that in order to increase the efficiency of certain industrial operations, attention must be paid not to speed nor even to the elimination of unnecessary movements as an end in itself. The first thing to do is to devise and give proper instructions in a rhythmic method of doing the work. In an earlier part of this report an account is given of a system of training which had as its object the reduction of the number of strokes employed. The wattmeter records show that fewness of strokes, and small variation in the number of strokes for the same operation, are always found when the work is based upon the natural rhythm of the worker, and that the opposite is the case where this rhythm breaks up and is replaced by conscious effort. It may therefore be assumed that the best way of teaching a rhythmic method of working is by means of limiting the number of strokes.

The next task is to endeavor to devise some method whereby this natural rhythm may be continued as long as possible and not be broken up by the onset of fatigue.

The experiment dealing with rest pauses may indicate a method of retaining this felt rhythm for as long as possible.

Fig. 3, giving a comparison between the two workers experimented upon, shows how much more effort No. 23 puts into her work as compared with No. 15, with the result that her output is considerably less throughout the day. The number of strokes employed by each worker vary little, but the pressure and duration of each stroke employed by No. 23 is greater throughout the day, and it has already been shown that she removes more metal from the article than is necessary.

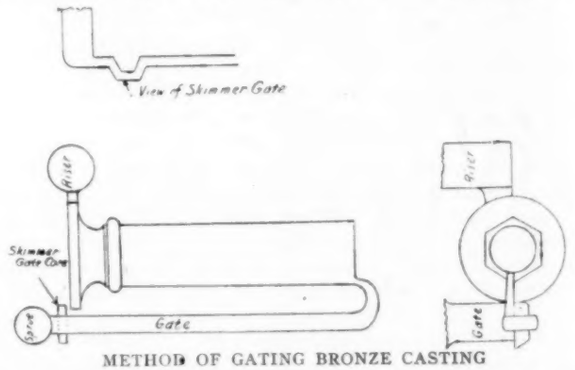
CAUSES OF FATIGUE

This would indicate that there are other factors besides the lack of rhythm which make for fatigue. There is a well-known dictum in golf that you must keep your muscles quite slack in order to get the natural swing, which is essential for a really effective stroke. The stroke may be perfect when regarded only from the line the head of the club describes through the air, but if there is a tendency to press—*i.e.*, put too much effort into the stroke, the result will not be good. Something similar to the fault of "pressing" at golf seems to be present in the case of Worker No. 23. Too much effort is put into her work, with the result that the time she takes to perform the operation in question steadily increases throughout the day, and there is never any recovery. With No. 15 increase in time is not so rapid and two recoveries are made during the day.

Casting Bronze

Q. Under separate cover I am sending a bronze casting (88Cu 10 Sb 2 Pb.), Albany sand, using Lycopodium as a parting, poured flat also upright in a skin-dried mould. What is the cause of small draggy holes on flat surfaces? Note none on round surface. Can it be possible that the polisher is at fault or has the metal been poured too hot? The casting is used for ornamental purpose.

A. On receipt of the samples I find that they look more like Copper 90%, Tin 10%, and Lead 2% than the mixture you give. The defect that appears on the surface under the gears shows sand. I would suggest that about 4 ounces of 15% Phosphor copper be used as a flux, and the casting be poured flat and gated like sketch. Use a good grade of flour to shake on the mold



METHOD OF GATING BRONZE CASTING

and blow off well before closing the mold. The core also should be dipped in a good grade of blacking, so that no sand will come loose. When pouring, the flour shaken on the mold will give you a nice face and should produce a clean casting, as the only defect is sand, coming either from the core or the gate.—W. J. REARDON.

Meeting of the British Institute of Metals

Summaries of Papers Delivered at the Annual General Meeting in London, March 8-9, 1922.

NOTES ON THE CORROSION AND PROTECTION OF CONDENSER TUBES

By G. D. Bengough, M. A., D. Sc.

Dr. G. D. Bengough's "Notes on the Corrosion and Protection of Condenser Tubes" deal with ten years' scientific investigation of the problem on its practical side. The recommendations are specific and categorical, and the document should be of considerable service to manufacturers of tubes and condenser plants, and to the engineers who use them. A review of these notes will be published in The Metal Industry in the near future.

THE INTERNAL MECHANISM OF COLD-WORK AND RECRYSTALLIZATION IN CUPRO-NICKEL

By Frank Adcock, M. B. E., B. Sc.

The problem was attacked in a conventional manner by observing under the microscope the polished and etched surfaces of metal specimens which had been subjected to various degrees of cold working and heat treatment.

Cast cupro-nickel, annealed until homogeneous, was selected as a suitable basic material since good etchings were obtainable with the citric acid attack (electrolytic). The metal was able to withstand a considerable amount of cold working and yet was sufficiently hard to permit of rapid preparation for micro examination.

Material which had been subjected to reductions of 50% and 88% by cold working was examined and observations were made on the nature and direction of certain strain planes which passed through most of the crystal grains of the distorted metal.

The possibility of a gradual distortion of the crystal structure apart from "slip" is also dealt with, and reference is also made to the cavities which appeared on etching the worked material.

In order to follow the process of recrystallization, cold worked specimens which had been annealed for fixed periods of time at progressively higher temperatures were examined miscroscopically.

It was noticed that the first effect of annealing was the accentuation of the "strain" markings previously visible in the worked specimens, followed at higher annealing temperatures by the appearance of new crystal grains which were generally associated with the previously mentioned "strain" markings and occasionally with old crystal grain boundaries.

New grains which appeared on the sites of the "strain" lines were frequently elongated in the direction of these lines and not necessarily in the direction of rolling and, further, the crystalline orientations of such grains were apparently not related to that of the old grain in which they were born.

A theory is put forward as an attempt to explain some of the experimental facts which are not altogether in agreement with the usually accepted views on the subject.

The hardness of the cold worked metal as indicated by the "Brinell" test did not begin to fall appreciably until the annealing temperature employed was such that new crystal grains were readily discernible under the microscope.

The paper is illustrated by thirty-six photo-micrographs.

THE EFFECT OF IMPURITIES ON RECRYSTALLIZATION AND GRAIN GROWTH

By the Research Staff of the General Electric Company, London. (Work Conducted by Major C. J. Smithells, M. S. C.)

This research was undertaken to determine the effect of small quantities of impurities in tungsten on the structure developed on annealing. Tungsten wires were prepared containing accurately known quantities of thoria, alumina, silica, lime, and the alkali metal oxides, in various proportions. The progressive changes in crystal structure on annealing at 2,500°F were followed in each case, and the distribution of the impurities in the metal determined. It was found that the refractory oxides, which ultimately segregate in the grain boundaries, exert a definite existence to grain growth, depending upon the nature and amount of oxide present. The alkali metal oxides alone have no influence upon grain-growth. An entirely new type of exaggerated growth has, however, been found to take place on annealing tungsten containing a few tenths per cent. of both a refractory oxide and an alkali metal oxide. Single crystals occupying the entire cross-section of the wire, and three hundred times as long as their diameter, are formed on annealing for a fraction of a minute.

The authors put forward an hypothesis based on the idea that crystal growth and recrystallization in metals depends on a difference in vapor pressure between neighboring crystal grains. On this hypothesis the new type of exaggerated grain-growth is satisfactorily explained.

The authors then proceed to a critical survey of published work on recrystallization and grain-growth from the point of view of the vapor pressure hypothesis. They show that it explains the known phenomena in relation to the effect of strain, grain-size, and temperature in regulating recrystallization and grain-growth on annealing.

The paper is well illustrated with photo-micrographs showing the development of the various types of structure produced on annealing tungsten containing different impurities.

FURTHER STUDIES IN SEASON-CRACKING AND ITS PREVENTION CONDENSER TUBES

By H. Moore, O. B. E., Ph. D., F. I. C. and S. Beckinsale, B. S. C.

The work reported in this paper has been carried out with a view to the application to Admiralty condenser tubes of the low temperature annealing previously recommended by the authors for the removal of internal stress in brass and the consequent prevention of season-cracking. Split tubes showed the usual characteristics of brass which had failed by season-cracking. The properties of condenser tubes of 8 different makes and also of a quantity of tube purposely made by methods inducing a state of high internal stress were determined before and after annealing at temperatures in the range 250° to 325°C. By numerous annealing experiments on flat strips of condenser-tube brass elastically bent to an arc of a circle and thus initially stressed to a known amount the effects of (1) initial hardness, (2) initial stress, (3) time, and (4) temperature, on the reduction of initial stress by low-temperature annealing were separately determined quantitatively. It was shown that:

1. The rate of reduction of stress at the lower temperatures is fairly rapid at first, but becomes slow when the stress has been considerably reduced.

2. As the temperature is raised the rate of reduction of stress increases.

3. The higher the initial stress, the higher is the remaining stress after a given treatment, in condenser tube brass of the same hardness.

4. The higher the hardness of the brass, the lower is the remaining stress after a given treatment and for a given initial stress.

The elastic limit and yield point of cold-worked condenser-tube brass were found to be raised by treatments which would greatly reduce initial stress a temperature of 250° to 275°C being the most effective in restoring elasticity in the overstrained material. The Brinell hardness of condenser tubes is commonly between 140 and 160, having been raised considerably by the final cold-drawing. Treatment at 280° to 300°C for 30 minutes is recommended for condenser tubes. This treatment reduces any initial stress present to a safe limit without injury to and in some cases with marked improvement in the strength of the tube.

SOME CASES OF FAILURE IN "ALUMINIUM ALLOYS"

By W. Rosenbain, D. S. C., F. R. S.

The note deals with cases of failure from growth or distortion occurring in what are frequently described as aluminum alloys. The author has found that the alloys which undergo distortion and disintegration of this kind usually consist mainly of zinc and are not properly described as aluminium alloys, the latter term being rightly reserved for materials consisting mainly of aluminium. Two cases are described in detail, one relating to an electricity meter casing which contained 81% of zinc, and the other to a name-plate used by Messrs. Reavell & Co., Ltd., of Ipswich, which contained 54% of zinc. In both cases distortion, growth and disintegration had occurred. It has been shown in a previous paper by the author (with Haughton & Bingham) that alloys consisting largely of zinc and also containing aluminium and copper, are unstable at the ordinary temperatures and are liable to changes of dimension disintegration. The failure of castings of the kind described is, therefore, not surprising. Careful distinction should, however, be made between alloys of this kind consisting largely of zinc and true light alloys of aluminium. The latter, if properly compounded and prepared, may be regarded as sound materials of engineering free from any risk of serious growth or disintegration, and it would be unfortunate if their use were in any way hampered by unfavorable experiences with alloys containing a large amount of zinc.

SOME MECHANICAL PROPERTIES OF THE NICKEL-SILVERS

By Prof. F. C. Thompson, D. M. T., B. S. C. and Edwin Whitehead

In earlier papers* one of the present authors has already dealt with some of the mechanical properties of these alloys. In this work a study has been made of the effect that annealing at different temperatures, and the different rates of cooling after annealing, have upon the tensile properties, the Arnold alternating stress values, and the Erichsen values of hard-rolled alloys containing 10, 15, and 20% nickel.

All the tests show the influence of the change which occurs at about 300°C., and in addition have revealed another temperature range at about 550°C in which abnormal results have been obtained.

Annealing within the range 300°-400°C results in a material of very low ductility, much lower than that in the hard-rolled state.

The best annealing range for the 10% nickel alloy is between 725° and 825°C; for the 15% nickel between 700° and 800°C; and for the 20% nickel alloy, about 800°C. As the nickel content is raised the tensile strength is raised somewhat, while the maximum ductility is considerably reduced. As typical of the results of annealing within the best range of temperatures, the following tests may be given:

Nickel Content, Per Cent.	Annealing Temperature °C.	Maximum Stress Tons, Sq. Ins.	Elongation Per Cent.	Reduction of Area Per Cent.
10	825	21	67	64
15	800	25	49	57
20	800	26	45	49

Quenching from the annealing furnace has no markedly beneficial effect, but if this is desired for economical reasons then the quenching should be done at once, without allowing the metal to cool, or erratic and brittle material may result.

So far as the Brinell hardness is concerned, almost the whole of the softening takes place in the first two hours, with a further slight fall as the time of annealing is increased. The greatest ductility, and also the highest Erichsen values are obtained after a duration of annealing of 1½ hours, for the small samples used. There is little to choose between annealing the alloy for a short time at a high temperature and for a longer time at a low temperature.

The ratio between the maximum stress and the Brinell hardness number is only about half for the hard-rolled material that it is for the soft annealed.

One of the most remarkable features of the results obtained is the high temperature to which the alloys can be heated without deterioration, especially when the sample is protected from oxidation. The furnace gases play a very important part in the production of "burnt" material; this incidentally is a point in favor of the salt-bath for this type of annealing. The Erichsen tests especially all show remarkably good results, even after annealing at as high a temperature as 850°C.

A FURTHER STUDY OF THE ALLOYS OF ALUMINIUM AND ZINC

By D. Hanson, D. S. C., and Miss Marie L. V. Gayles, M. S. C.

The present work was undertaken with a view to investigating further the constitution of the phase known as delta in the diagram of Rosenhain and Archbutt. Preliminary experiments with alloys containing 70, 60, 50 per cent. of zinc when slowly cooled to 284°C., after prolonged annealing at 420°C and quenched, were found to be duplex in structure. The inconsistencies between these micro-structures and those suggested by the existing diagrams led to a redetermination of the solidus from 81 per cent. zinc to 20 per cent. zinc. The results obtained differed appreciably from those of previous workers; the line representing the peritectic reaction was found to extend up to a composition of 70 per cent. zinc as against 40 per cent. zinc in previous diagrams.

Constitution of the Solid Alloys.—Microscopic examination of alloys, following special heat-treatment, disproved the existence of the compound Al_2Zn_3, and showed that the nature of the change in the alloys at the temperature of the horizontal line at 256°C.

* Journal, Institute of Metals, Vol. XV, NO. 1, 1916. Journal, Institute of Metals, Vol. XVII, No. 1, 1917.

in Rosenhain's and Archbutt's diagram was identical with an ordinary eutectoid transformation; the decomposition of the beta phase leading to the "pearlitic" structure commonly found in the alloys.

Further work on alloys at temperatures below 256°C. showed that the solubility of the alpha constituent in the gamma constituent decreased with the temperature.

Age-hardening. Alloys containing the beta constituent were found to possess the property of age-hardening spontaneously at room temperature after being quenched from above 256°C., while those containing the gamma constituent showed the property, but in a much less marked degree.

NOTE ON THE ASSAY OF GOLD BULLION

By Arthur Westwood.

Mr. Westwood suggests a new method of assay of gold bullion. The method universally adopted at the present time of assay by cupellation, inquartation, and subsequent parting, is of very ancient origin. In this latest method the assay sample is not cupelled but is melted and balled up under steam or an inert gas. For the usual inquartation, copper is recommended in place of silver.

THE RATE OF COMBINATION OF COPPER AND PHOSPHORUS AT VARIOUS TEMPERATURES

By Prof. C. A. Edwards, D. S. C., and A. J. Murphy, M. S. C.

The object of the authors' research was to determine the temperature at which rapid combination between copper and phosphorus commences, and to trace the effect of time on the progress of the reaction velocity. The rate at which solid copper combines with phosphorous vapor at temperatures up to 700°C. has been determined. When using ½-in. diameter copper rod, it was found that the maximum rate of increase of phosphorization for a given rise of temperature was at 640°C.

If this temperature be used, the authors consider that the chief advantages are (1) a quick but safe rate of phosphorization at a low economic temperature; (2) the operation can be controlled so as to prevent the formation of any liquid; (3) it is possible to obtain an alloy containing more than the percentage of phosphorus which is required commercially.

It ought to be an easy matter, it is contended, to evolve a continuous process which would be free from danger and give little or no loss of phosphorus.

The Grant Memorial

In 1901 a competition held at Washington, D. C., was instituted to design a suitable memorial in honor of General Ulysses S. Grant. The monument has been placed at the head of the mall, west of the Capitol. Its cost has been about $250,000.

The judges of the competition were Charles F. McKim, Augustus Saint Gaudens and Daniel C. French. In April, 1902, the competition was won and the work of its execution was awarded to Henry Merwin Shrady, a young sculptor who was almost entirely unknown to the art world and to Edward Pierce Casey, associated with him as the architect who designed the platform, the various pedestals and their proportionate relation to one another.

The Memorial is now completed except the two bronze panels that are to be inserted in the broad but opposite faces, respectively, of the pedestal to the equestrian statue.

The horse and his rider is the second largest equestrian statue in the world; the larger one which exceeds this one by only one or two inches is that of Peter the Great at Petrograd.

In the foreground is the cavalry group, which represents a color squad of a cavalry regiment making a charge on the field of battle. There are seven troopers with drawn sabers with their mounts in a gallop. One of the leading horses has been shot down and his rider killed, but the others keep on with colors flying.

In the central group the height of the horse and rider is 17 feet. The statue stands nearly 22 feet from the level of the main platform, making the monument nearly 40 feet high.

In the background is the artillery group. It represents a one-gun battery, practically just wheeling into position, for the sculptor has seized the moment when a signal officer has just overtaken the flying artillerymen and ordered them to stop, dismount and get into action. The battery consists of three horses, two riders and two artillerymen sitting on the caisson behind them.

Four bronze recumbent lions are shown on separate marble pedestals, one on each corner of the central group. At the rear and on each side of the central group there is a separate entrance to the platform and the two entrances are appropriately marked by two tall bronze lamps, surmounted each with five glass globes for the lights.

All of the various groups excepting possibly the lions and the tablets were cast in sections, and all of them made at the Roman Bronze Works at 275 Green Street, Brooklyn, N. Y.

The Equestrian statue weighs 10,500 pounds; the Artillery group 28,600 pounds; the Cavalry group 31,400 pounds; the lions 2,400 pounds each; the lamp 360 pounds each or a total of 81,540 pounds of bronze.

CAVALRY GROUP GENERAL GRANT ARTILLERY GROUP

Some Cases of Failure in "Aluminium" Alloys

A Note Showing That Many of the Aluminium Alloys Which Fail Are Not Really Aluminium Alloys

By W. ROSENHAIN, D.Sc., F.Inst., Vice-President British Institute of Metals*

The importance of alloys of aluminium as materials of engineering has increased in recent years, and so much time and attention has been devoted to researches on these materials, that records of practical experience obtained with them are of special interest. In this connection a good deal is heard at times of cases of failure arising from growth or distortion in what are described as aluminium alloy castings, particularly so-called die-castings. Several cases of failure of this kind having been brought to the notice of the author, he thinks it worth while to place the details on record, in order to counteract as far as possible the damaging effects of such statements upon the reputation of perfectly satisfactory and reliable materials.

Of the number of cases which have come under examination, two typical ones have been selected for description here. The first of these was a thin-walled casting forming the outer casing of an electricity meter which had been in use under one of the municipalities of the London area. These meter cases had distorted and cracked in the course of one or two years, and had all to be replaced. The cast sent for examination was very badly buckled and cracked, and the material could readily be broken up with the fingers.

Casual examination at once showed that the material could hardly be described as an aluminium alloy in the ordinary sense in which that term is used as covering light alloys consisting mainly of aluminium. A chemical analysis was accordingly made, with the following results:

Aluminium, 17.1; zinc, 81.21; copper, 0.40; tin, 0.68; iron, trace; magnesium, trace.

It will be seen at once that the above figures prove the material to be not a light alloy of aluminium but an alloy consisting mainly of zinc, containing some aluminium and a small amount of copper.

The second case to be described relates to a much simpler form of casting. This is a cast name-plate used on a particular type of air compressor. One of these name-plates, originally described as an aluminium casting, after being attached to the machine in question for a number of years, during service in India, was returned to the makers of the machine in the condition illustrated in the photographs, Figs. 1 and 2. Fig. 2 shows a front view of the plate, on which the four screw-holes by which it had been firmly attached to the iron casting of the machine are clearly seen. On this photograph the growth and distortion of the plate are indicated by the peculiar distortion of the lettering. The true extent of this distortion, however, only becomes evident in a side view of the plate, as shown in Fig. 1. This plate was submitted to the author for examination by Messrs. Reavell and Co., Ltd., of Ipswich, who have very courteously given him permission to publish the details in full.

Preliminary examination indicated that this plate also was not truly a light alloy casting, since its weight was obviously too great. Chemical analysis was therefore carried out with the following results:

Aluminium, 43.12; zinc, 54.00; copper, 1.57; iron, 0.62; tin, 0.52; silicon, 0.17.

The above composition shows that here again is an alloy consisting mainly of zinc, although the proportion of aluminium is distinctly larger than in the previous example. Copper is again present. This particular alloy does not fall within the range carefully studied in the paper (by the author, Haughton, and Bingham) referred to above. At the same time it is likely to contain at all events a certain amount of the unstable phases described in that paper, and the failure and disintegration of this name-plate are probably an example of the same kind of action as that studied in that paper. Again, however,

FIG. 1. SIDE VIEW OF PLATE

the alloy cannot fairly be described as an aluminium alloy in the usual sense.

The two examples cited and described in detail above are typical of others which have come under the author's notice. They serve to show that the materials which undergo serious growth, distortion and disintegration in the course of service, are not, properly speaking, aluminium alloys in the ordinary sense of that term, and that the frequent reference to cases of such failure and distortion among aluminium alloys must be discounted as referring to materials of really an essentially different type. It is

FIG. 2. FRONT VIEW OF PLATE

the object of the present Note to draw attention to these facts in order to assist in removing what is undoubtedly a strong prejudice against useful and valuable materials of engineering.

*A note read at the meeting of the British Institute of Metals, London, March 8-9, 1922.

Recovery of Secondary Metals in Russia

A Description of Methods in Use in Russia Before the Revolution

Written for The Metal Industry by M. G. KORSUNSKY, Metallurgist

It is necessary to distinguish between three classes of scrap metals, as their recovery is subject to quite different methods.

In one class are scrap, zinc, lead, hard lead, soft and hard aluminum. In Russia, as in all other countries, these metals are not so apt to be found in form of turnings and other small sized scraps, so the old-metal dealer gets them in bulky pieces. This enables him to distinguish the grades, and by plain sorting to prepare them to be remelted into ingots. As this practice calls more for a sound commercial judgment, than knowledge, it has very many adepts in Russia. There were not less than 10 plants turning out ingot copper, aluminum lead and zinc in quantities of 200,000 to 500,000 lbs. per year. Of course they did their business in old fashioned pit furnaces, sometimes of the type used for the manufacture of calamine brass in the eighteenth century.

In another class are bulky remnants of different machinery parts. Although they represent everything from the standard gun metal to the lead bearing bronzes and high zinc brasses, they are sold promiscuously under the name of bronze. These metals constitute the bulk of the material used by the jobbing founders, of which at least 300 existed in different parts of Russia. They turned the scrap to raw castings which were commonly miscalled "phosphor bronze" or even "chemical bronzes."

To the third class belongs the diversified copper and copper alley scraps, sold only to large dealers, with a guarantee as to the copper content. These scraps were largely reduced to second grade copper, and this operation was practiced by three concerns, the largest of whom turned out some 3,500,000 lbs. of 99.6% copper annually.

THE OLD PROCESS.

The old second grade copper people did not care much about system in their operations, gradually turning from metal peddlers to metal dealers, to silver melters, to zinc melters, etc. The only process with which they were familiar consisted of melting metals in a crucible or a small open flame furnace and they were afraid of any idea of mechanical or hydraulic dressing of their raw materials. Therefore, their methods consisted of:

(1) Melting ashes, skimming and foundry refuse with coke, burned pyrite residues (from the neighboring sulphuric acid plants) chalkstone and quartz in a water-jacketed blast furnace. The customary day's charge had some 150,000 lbs. with about 7% of copper in it. This process allowed the extraction of an alloy having about 70% copper and a slag with 0.5% copper in the average.

(2) Melting bulky metals and the blast furnace alloy in a reverberatory furnace quartz lined and fed with quartz to scorify any foreign metal of the charge. Slags were skimmed three times for every charge. The first went to the blast furnace and the other two were returned to the reverberatory before putting in a new charge.

In one plant the product of the furnace was averaging 98% of copper and its refining was finished in a reverberatory of smaller size. Both reverberatories were burning oil with a very primitive drooling burner. To eliminate the foreign metals air was blown under the surface of the molten charge from a Yager blower, giving a pressure of 1500 mm. of water.

Although this process was very simple and did not call for a heavy outlay for structures and equipment, it was very uneconomical because:

1. All zinc, tin and nickel were oxidized and lost.
2. Neither the blast furnace nor the reverberatories could go without troubles more than for two-three weeks.
3. Much fuel was wasted.
4. Pyrite residues, chalkstone and quartz costs were high.

THE LATEST PROCESS

(1) Every load of incoming piece-scrap was carefully examined and such pieces about which the origin and contents, not very much doubt existed were put in special bins. In this manner were obtained heaps of copper, low brass, high brass and gun metal. They were melted in two-down draft furnaces (for copper and gun metal) and two tilting crucible furnaces for brasses. In the first the melted mass was subjected to a short period of oxidation by air, after which it was poled. The product was cast in ingots subject to a careful analysis.

(2) Piece metal of doubtful composition was melted in a large reverberatory and heavily overheated. Then the furnace was closed and connected with a water cooled vertical tower, which was always kept in clean conditions. A mixture of approximately 2 volumes steam and air, superheated up to 500° C. was blown under the surface of the metal and the zinc removed in form of impure zinc oxide. This was sold to customers who did a special business in zinc dust manufacture.

The remaining metal was examined in a rough-quantitative-way for the presence of tin and lead. If tin was shown to exist in quantities not less than 4%, and lead was absent (less than 1%), the mass was cast in ingots and used for gun-metal castings (after a cleaning with silicon-copper. If, on the contrary, the tin content was low and lead was present, the molten mass was carefully oxidized, the slags removed and reduced to an alloy in a small cupola furnace, while care was taken to burn out most completely the whole iron content. The resulting alloy was granulated, and it was used as a second-rate addition in the manufacture of plastic bronzes.

(3) Ashes, of which the major portion was coming from time-fuse plants, were carefully guarded from any mixture with foundry skimmings, sands, etc. They went to a washing installation, consisting of three consecutive tanks with a horizontal shaft, bearing rabbles and three settlers. While the ashes were removed by a water-current to the settlers, the grainy metal largely remained in the tanks. Both the tailings and the grains were dried, the iron removed by a magnet and then subjected to further treatment. The grain were briquetted by a powerful friction press to round pieces of 4″ diameter, and 3″ height, and then melted to ingot brass. The ash tailings, mostly a mixture of oxides of copper, iron and zinc with sand, were mixed with some lime and a heavy addition of copper matte (30% copper). The mass was slightly briquetted, pot roasted to enforce agglomeration, and reduced to an alloy in a water-jacketed blast furnace. This alloy went to the furnace, where metals of doubtful composition were reduced to copper, or copper-tin alloy.

The described process worked very well and saved much labor and metal. Nevertheless, no figures for savings could be obtained, as the prices for everything and especially fuel and transport fluctuated too much.

Influence of Cerium on Aluminum and Other Light Metal Alloys

A Description of Some Experiments With a View to Improved Melting and Possible Soldering of the Light Metals*

Translated for The Metal Industry by R. E. SEARCH, Exchange Editor

In the year 1912 at the Institut für Metallhüttenwesen und Elektrometallurgie der Technischen Hochschule Aachen, O. Barth established an investigation of the chemical resistance of alloys, which exercised the favorable influence of small quantities of cerium upon the physical properties of aluminum (D. R. P. 246484). (Dissertation of O. Barth: "The increase of the chemical resistance capacity, while mechanically well workable, for the purpose of constructing useful alloys.")

According to the investigations of Barth about the constitution of Ce-Al alloys, aluminum in the solid state had the power to dissolve at least 11 per cent of cerium. This claim, with the aid of the cooling curves and an investigation of the structure, obtained results in opposition to the complete diagram published by Vogel in the meantime, according to which aluminum had no power to take cerium into solid solution.

Now Vogel has given less direct attention to the cerium-poor alloys whilst the investigations of Barth extended exclusively to them. Therefore Engineer Schulte holds the results of Barth to be plausible and believes that the point "K," as Vogel assumes, does not denote the eutectic point. (See Fig. 1.)

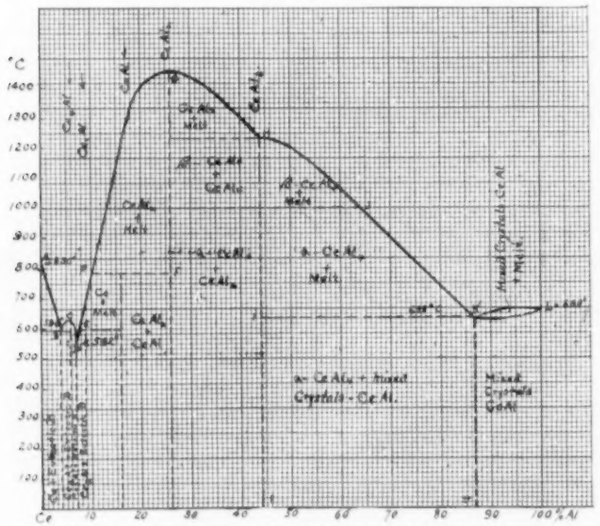


FIG. 1.—THERMAL EQUILIBRIUM DIAGRAM OF CERIUM AND ALUMINUM

PROOF OF THE PROPERTIES OF THE AL-CE ALLOYS

From the work of Barth it follows, that small quantities of Ce additions (0.2 per cent) brought about the greatest improvement of the properties. Although cerium itself alloys readily and without any loss by oxidation it appears for convenient alloying to be advisable, first of all, to make a cerium-rich aluminum intermediate alloy. (This is the most approved kind of foundry practice for all metals to be melted or mixed with aluminum for the purpose of making an aluminum alloy.) To obtain the utmost homogeneous materials and reliable comparative values, a single fusion was made wholly for the purpose of this investigation and worked in parallel under the same conditions.

In Table 1 are collected the results of the investigation upon the tenacity, ductility, conductivity and stability towards acids.

Although the assembled results of the investigations of the favorable values obtained by Barth, especially what relates to the tenacity of the aluminum refined by cerium were not fully confirmed, yet very good ductility values were obtained. However, with 0.19 per cent cerium and with annealed material, an elongation of 34.1 per cent was obtained, which corresponded relatively to pure aluminum, with an increase of about 19 per cent. On the other hand the tenacity does not appear to be affected favorably.

The grain-size did not seem to be changed. The working capacity of all the bars was equally good, although the cerium-richest alloy with a high speed of working showed an inclination to form fissures. Also with the foregoing investigation, the pure copper alloys gave a striking metallic ring. The carefully polished surface etched with caustic soda showed no noticeable difference compared to pure aluminum under the same conditions. With small cerium additions the apparent increase of the conductivity is so slight that it remains practically of no importance.

On the other hand, according to the investigations of Barth, the stability towards nitric acid, hydrochloric acid and caustic potash solution undergoes a considerable decrease. Also from the experimental treatment with acetic acid and common salt solutions it follows that cerium-aluminum alloys are not as stable as pure aluminum. This slight difference is so unimportant that the keeping quality of cooking utensils cannot be affected by it.

TESTS OF THE INFLUENCE OF CERIUM UPON THE PROPERTIES OF SOME IMPORTANT ALLOYS OF THE LIGHT-METALS.

After the investigation of the binary alloys of Al-Ce in general (the results of Barth had been confirmed), the investigation of the ternary Al-alloys could go forward.

Among the important alloys whose properties could be influenced by means of cerium-additions, there were investigated: Al-Cu-Ce; Al-Mg-Ce; Al-Zn-Ce; Cu-Al-Ce; and Al-Ni-Ce. Finally the influence of Ce upon electron metal (an alloy of about 90 per cent Mg and the balance of Zn with possible slight additions of Al, Sn or Cu) was investigated.

a. Al-Cu-Ce. As a starting point an alloy of Al-Cu with about 3 per cent of Cu was chosen. According to Schirmeister (report upon the knowledge of the binary Al-alloys with regard to their technical properties—Dissertation, Aachen, 1914), these alloys are very valuable, because the maximum tenacity reached shows very great stability towards the weather and yet not too great a reduction of the melting point. Based upon the cerium-aluminum alloys experiments should be made to ascertain the amount of ductility secured by such additions of cerium. The tests with pure aluminum were worked out in the manner already described. (See Table 2.)

* From Influence of Cerium on the Properties of Aluminum, and Some Important Light Metal Alloys, by Dipl.-Ing. Josef Schulte, in Metall und Erz, May 22, 1921.

Also, as was to be expected, accompanying the investigation of the ternary alloys an important increase of the ductility could be observed (about 6.7 per cent). No considerable increase of the tenacity could be detected.

A microscopic study of various polished specimens produced no tangible results.

The conductivity and stability towards acids of the Al-Cu-Ce alloys were similar to the Al-Ce alloys in the same circumstances.

b. **Al-Mg-Ce.** For these alloys a magnesium content of about 4 per cent appears to be the most favorable. With this amount there is a considerable increase of the tenacity, but the ductility falls from 34 to 20 per cent. The results obtained are summarized in Table 3.

With these investigations there appeared to be an important increase in the ductility; the tenacity is not affected and fluctuates between narrow limits.

Photos of the alloys show the usual structural formation. Because the known slight stability towards the weather and to acids of these alloys, the conductivity towards acids were disregarded in the investigations.

c. With the addition of cerium to an alloy of Al containing 10 per cent Zn and an alloy of Al with 4 per cent Ni as well as with electron metal, no difference was established.

With Al-alloys containing 25 per cent Zn, with an alloy of copper containing 10 per cent Al and with pure copper accompanied by considerable increase of grain size, the results were negative.

THE INFLUENCE OF CERIUM UPON THE IMPURITIES OF ALUMINUM

Barth believed that the favorable influence of cerium could be traced back to two causes:

1. To a reduction of the silicon content of the alloy by the formation of a chemical compound, $CeSi_2$, with combustion of the same to CeO_2 and SiO_2. Reduction of the CeO_2 by means of the great excess of Al and the slagging off of the silicic acid.

2. Purification of the aluminum by the admixed and dissolved gases. Of both reasons cited the first is no longer tenable because of the investigation carried out upon the Al-Ce alloys; of a reduction of the small traces of silicon nothing is to be observed. As to the photos used by Barth upon the basis of the now known complete diagrams of Ce-Al, as confirming his view, there is nothing to be noted. Also, if an improvement of the properties of aluminum by the expulsion of the silicon were probable, then the second statement of Barth's hypothesis, would appear to be accurate and be of subsequent value.

At the instigation of Privy Councillor Borchers, the author investigated the influence which cerium exerted upon the aluminum-nitride formation resulting from the absorption of nitrogen by the aluminum. The nitrogen determination was made by the Kjedahl method. The conjecture that the small quantity of the cerium addition was not without influence upon the nitrogen content of the Al was completely confirmed by the nitrogen determination that was made.

The influence of cerium upon the nitride formation during the melting of pure aluminum is to be further carried on because of its vital importance. In agreement with the results obtained in the investigation of the mechanical properties, the nitrogen content, first of all, drops quickly from 0.028 per cent with pure aluminum to 0.014 per cent treated with an addition of 0.2 per cent cerium. If there were a further increase of the cerium then the reaction on the nitrogen recedes further but slowly (with 0.77 per cent cerium there will still remain 0.0094 per cent of CeN.) From a certain limit downward, this limit apparently lies at about 0.2 per cent Ce, and it overbalances the unfavorable influence, which cerium appears to exert when it is relied upon as an alloying constituent.[1]

SUMMARY

The influence that small quantities of cerium additions exerted upon the physical properties of pure aluminum and of Al-rich alloys, as well as upon electron metal, was investigated.

With pure aluminum and with alloys of aluminum containing about 3 per cent Cu, and of aluminum containing about 3.3 per cent Mg, with practically the same tenacity and conductivity, an important increase of the ductility was established. With an alloy of aluminum containing 4 per cent nickel and with electron metal, no difference could be established. With Al-alloys containing 25 per cent Zn, with an alloy of copper containing 10 per cent Al and with pure copper the results were negative.

It was analytically established that the favorable influence of cerium upon the expulsion of the nitride depends upon the amount of the nitrogen that remains present. This favorable action of cerium appears to be thoroughly impaired by the addition of the already small quantities of foreign metals.

The system Al-Ce has been investigated recently by Muthman and Beck (1903) who obtained an alloy containing 73.70 per cent Al and 25.25 per cent Ce (with some silicon). In the treatment of the same with hot caustic soda the aluminum was dissolved from the original alloy and there remained a product with the composition of Al_4Ce, in fine needles (57.6-57.8 cerium found, calculated 56.36 per cent). The composition of the compound remains, also, always, the same with a greater quantity of Al. This result stands in complete harmony with the Vogel Diagram (1912), see Fig. 1. The heat of formation of this compound is extraordinarily high. This diagram, so indistinct in the original text of the Schulte investigation, has been checked up with the same diagram published with fuller and more explanatory details, in the latest volume, Heft 3, p. 773, of Dr. W. Guertler's opus maximus, the unrivaled work on Metallography.

In the Zeitschrift für Metallkunde, of Sept., 1921, p. 436, Dr. Guertler makes some interesting comments upon the investigations pursued by Engineer Schulte. He seems to approve the latter's conclusions, so far as he went, and again calls the attention of his readers to the remarkable fact that cerium is the only metal that has a greater molecular heat of combustion than aluminum and for that reason is able to remove the alumina skin that forms on the bath of aluminum in a molten state. (Anhydrous zinc chloride will operate in the same manner, but perhaps not so perfectly or completely.) One of the very interesting points Dr. Guertler makes against the Schulte investigation is, that nowhere does the latter state what kind of cerium he made use of, and this omission is of vital importance from the dual fact, first, that pure cerium is one of the very rarest of rare metals and almost unobtainable except in minute quantities. The other point is that the so-called commercial cerium contains lanthanum and other metals of the cerium group, such as didymium and samarium and also that it may contain not more than 50 per cent of real cerium. Another point is made in the Doctor's suggestion that it would have been of great technical and practical importance to have ascer-

[1]From the point of view of the foundry technician, this conclusion is one of the most interesting that has been drawn, and it is also of the utmost practical importance, and should be jotted down in the private note-book of every foundryman who is experiencing any difficulty in the making of sound, strong, reliable aluminum castings.

tained how much cerium remained in the alloy after it had performed its apparent function of removing impurities from the aluminum.

While technically and from a laboratory point of view it would be of great value to find some way in which all such investigations could be carried on with strictly chemically pure cerium, obtainable in unstinted quantity, still from the foundry view point it matters little if there is even only 50 per cent of real cerium in the commercial article provided its addition to a light aluminum alloy will increase its ductility by fully 19 per cent, or any where near it; for the weak point of the best of the light aluminum cast alloys is their meager elongation (about 5 per cent). The tensile strength is good enough for almost all the purposes for which such alloys have been used up to the present time, and an unbiased view must acclaim this discovery of the increased ductility as a distinct gain in the fields of endeavor, whether purely scientific or the practical.

Finally Dr. Guertler has this to add: "With respect to the influence of cerium upon the impurities of the materials to which it is added, the author takes issue with the theory originally advanced by Barth, namely, the theory of slagging off of silicon by means of the cerium present. It was clearly demonstrable, however, about the reduction of the nitrogen content. For a certain limit, say up to 0.2 per cent cerium, the unfavorable influence of cerium as an alloying constituent is overbalanced."

TABLE 1

	No.	1	2	3	4	5	6	7
	% Ce.	0	0.25	0.11	0.19	0.33	0.45	0.77
Properties:	Condition.							
Tenacity in Kg per sq. mm.	Annealed .	8.63	8.85	8.93	9.1	9.1	9.1	9.15
	Cold worked K=70%. ..	15.25	15.40	15.10	14.8	15.	15.9	16.
	Cold worked K=90%.	18.3	....	18.3	18.3	....	18.3	....
Elongation in %.	Annealed ..	28.6	30.5	32.4	34.1	34.1	32.6	32.3
	Cold worked K=70%.	4.63	5.7	6	6.4	6.5	6.18	5.12
	Cold worked K=90%.	1.18	....	3.35	3.7	....	2.92	....
	Cold drawn.	30.4	30.4	30.12	30.20	30.12	30.12	30.12
Conductivity	Cold drawn							
Stability towards acids in milligrams per sq. cm.[1]	towards 25% acetic acid .	4	4.2	4.3	4.3	4.5	4.7	4.8
	Cold drawn 10% common salt	0	....	....	0.09	....	....	0.15

[1]Control investigation with cast bars confirmed the results of the investigation of the tenacity and ductility.

Period of experiments: 24 hours; Temperature: 98 deg. C. K., the indicated or assumed eutectic point.

TABLE 2.

	No.	C_0	C_1	C_2	C_3	C_4
	% Ce.	0	0.09	0.19	0.31	0.46
Tenacity in Kg. per sq. mm.	Annealed	17.7	18	17.5	17	17
	Cold worked .. K=60%.	23	23	23.7	23.9	24
Elongation	Annealed	24	25	25.6	22.6	22
Per cent	Cold worked .. K=60%.	4	4.5	5	4	4
Conductivity	Cold drawn ..	27.02	27.02	26.6	26.04	....
Stability towards acids in Mg. per sq. mm.	Cold drawn towards 25% acetic acid	6.88	6.91	7.02	7.6	7.3
	Cold drawn towards 10% com. salt	0	..	0.22	..	0.26

Period of experiments 24 hours; temperature, 98 C.

TABLE 3.

Property.	No.	M_0	M_1	M_2	M_3	M_4
	% Ce.	0	0.1	0.13	0.16	0.22
Tenacity in Kg per sq. mm.....	Condition,					
	Annealed	18	19.7	19.9	19.9	...
	Cold-worked . K=60%.	37.5	38.8	40.	40.	38.4
Elongation in %	Annealed	20	23.6	22	24	...
	Cold-worked K=60%.	2.29	2.31	2.54	2.98	2.28

Control tests the same as in Table 1.

(In view of the statement authorized by Dr. Guertler on page 772 of Heft 3 of his additional volume on Metallography, the abstractor offers the suggestion, that with a powdered alloy of the proportions of the compound Al_4Ce, used as a soldering flux for aluminum itself or its light alloys, it is quite possible that the hitherto insurmountable obstacle of soldering aluminum or its important alloys, may be finally overcome; the one caution necessary is that the cerium part of the compound be free of any contaminating particles of any of the other metals of the cerium group, or any other metals that must be regarded as impurities.)

Machining Aluminum

Q.—We are machining large quantities of aluminum castings used on vacuum cleaners and milking machines and are desirous of knowing the correct speeds, lubricants, also the grinding of tools for cutting—give us full information covering this.

A.—For turning, drilling, or milling high speed is found best and the tools should have acute cutting edges preferably finished on an oil stone to secure a nice finish. The clearance angle on the lathe tool should be 15 to 20 degrees and a 5 degree top rake may be given. The top rake should be modified according to the rigidity of the work as with light work there is a tendency for the tools to dig into the metal. Cutting speed of about 600 feet per minute is permissible and a heavier and faster feed than with brass may be employed. For threading purposes the use of paraffin as a lubricant is preferred to turpentine, which tends to leave a resinous deposit that may cause the threads or screws to bind.

In milling the best results are obtained by the use of built-up tools. The cutters should cut only at the extreme points and not have a scrapy action as with brass. Cutting speeds of 500 to 600 feet per minute should be used.

When grinding aluminum the wheel should first have a piece of paraffin wax held against it to fill up the pores. A wheel so treated will not cause the metal to stick or adhere to it and will not require to be so frequently dressed. Any kind of grinding wheels may be used (emery corundum, carborundum, cystolon, etc.). Some manufacturers have special wheels made for aluminum grinding.

It is best to use a single cut, as cross-cut files are readily clogged and require frequent cleaning with a filebrush. A quick method of cleaning is to immerse the file in a strong solution of caustic soda which rapidly dissolves the aluminum. Files so treated should be washed in water and dried in sawdust or they will quickly rust. For finish or smooth filing the file should be kept wet with paraffin or water to attain a smooth finish.—P. W. Blair.

Fuel Data on Brass Melting Furnaces

Are the Published Figures Reliable? How Are They Arrived At? The Disclosure of a Few Plain Facts to Prove That They Are Often Unalloyed Bunk

By WILLIAM H. PARRY

From time to time we read in the columns of the technical press accounts of the wonderful efficiency of this and that fuel as applied to the melting of brass. While there is no question as to the honesty of intent of the writers of these articles, there is often considerable discrepancy between the data as published and the actual facts.

In the January, 1922, issue of THE METAL INDUSTRY* the statement is made that 100 pounds of ingot and scrap brass was melted with one gallon of oil in a tilting crucible furnace. There is nothing said as to what kind of oil was used, the method of measuring same, the time of melting, the "chimney loss" or the price of the oil per gallon.

This is on par with much half baked data turned loose on brass foundrymen who have from past experiences become very wary and weary of unsupported statements bearing on brass furnace operations. Rash claims as to what can be done with a gallon of oil are just as valuable as the figures imply, and when there is no mention made of how the gallon was measured, and whether it was pre-heated or not, the wise foundryman gives it no further consideration.

It is an astounding state of affairs, considering the enormous volume of alleged data published on this subject, by both the technical press and the manufacturers of oil burning furnaces that not one word has ever been mentioned as to how the quantity of oil has been measured. Possibly they have assumed that the oil passing through an oil meter is ample evidence of the accuracy of the gallon unit of measurement. There is not one oil meter on the market to-day, that I know of, and it is very doubtful if there ever will be one, that will measure crude or fuel oil within five per cent. minus or plus of absolute accuracy.

If these measuring devices were always consistent in either dial readings, minus or plus, then their inaccuracies could be provided for by making allowance in either direction, but, as they are not, and cannot be, by virtue of the variable nature of this fluid which frequently contains solids, then any measurement made through them cannot be relied upon.

There are so many conditions entering into the accurate measurements of fluids other than the passage through a positive displacement or current meter devices, that it is generally admitted by those versed in the art, that there is but one correct method, and that is measurement by volume on the basis of 231 cubic inches to the gallon.

Perhaps an actual instance of what happened in the Pennsylvania oil country, but a few years ago, will best illustrate this point. A shipment of oil measuring meters on reaching their destination were tested for accuracy by the buyers and, through not guaranteed to do any better than five per cent. minus or plus, by the makers thereof, were found to be as reliable as the proverbial weather vane, in that they varied twenty to twenty-four per cent. from the straight and narrow path. Some minus and some plus. The telegraph wires were called into play and an expert packed his grip with a clean collar and an extra pair of socks for the overnight trip to the scene of trouble.

The meter testing machine used by the oil country folks was of the most modern pattern approved by all the authorities dealing with such devices, and in successful (?) use all over our fair land. The alleged expert tested every one of the meters and sure enough they cut up some very peculiar didoes; in fact the same meters never registered the same when tested three and four times, so that there was nothing lft to do but to repack them all and ship back to the old home grounds in Brooklyn, where it was found that the original tests were verified and once more they were shipped to the oil country, with word to the effect that they were O. K.

In due time the telegraph wires were kept hot, with the news that the meters were as bad if not worse than on the first tests, and another expert, known as a "trouble finder" was sent post haste to the land of oil derricks, only to find, after a series of most exhausting tests, involving the calibrating of about all the weighing machines in that part of the country, that the meters could not be induced to behave along the lines of strict propriety.

To understand this dilemma better we will state that the commercial method of testing most fluid meters is by weight, that is to say, running through a number of cubic feet or gallons into a tank, and if their known weights per cubic foot or gallon coincide with the dial readings, then everything is lovely. As it never occurred to either expert, or to the purchasers of these meters, that the testing outfit was at fault, the acceptance or rejection of the meters was held up pending the next move on the part of the manufacturer.

A council of war was held by the powers that be, and, in the discussion that followed, it was suggested by a man who had never tested a meter in his life, that perhaps a volumetric test by putting a known quantity of oil in a container elevated sufficiently to give the desired "head" to force the oil through the meters might prove that the meters were as represented.

While his suggestion was not greeted very enthusiastically it was realized at last that there was nothing else left to do, so the trouble finder didn't bother to pack his grip for that trip, but he did buy a five-gallon can instead and entered into the State of Pennsylvania looking like a "Hootch Hound"—but **not** as they look today.

To make a long story short the test by volume proved that the meters were just as represented; it also proved very conclusively that their most approved testing machine was a joke, in that the oil stream picked up enough air at times and created a vacuum at others, so as to foul the registration beyond bounds.

Another weakness of meter testing machines is that they are frequently at fault in jetting the fluids with great force and little volume where they will do the most harm, and, if the piping is so designed as to prevent the natural flow of the fluids to the meter, any old registration can result.

Now, in the light of these facts, what chance is there for the proper measuring of fuel or crude oil when used to melt brass unless the volumetric method is used to the total exclusion of meter measurements.

*See Page 15.

Again crude and fuel oils vary greatly in density, and there is a great difference between oils having a paraffine or asphaltum base, so that it is not reasonable to expect than any measuring mechanism such as a meter can register correctly or near it.

There is at times grit present in these oils, and while all meters are equipped with screens to prevent solids of sufficient size from entering their measuring chambers to stop the registering mechanism the screens must not be of too fine a mesh, else the sludge will mass on them and stop all registration.

Positive displacement meters for oil registration are theoretically the only kind to use, but in practice they fail, while the velocity or current meters in so far as correct registration is concerned are one huge joke.

Mention is also made of the wonderful efficiency of producer gas, and if one were to abide by the figures presented as to what to expect in gas from one pound of coal, all would be well, but there are other factors that set at naught all the efficiency figures quoted for this poorest form of gas.

Makers of gas producers very often claim that any kind of coal can be used in their machines, either bituminous, semi-bituminous or anthracite, and in a measure these statements are true, but at what cost? Anybody who has had anything to do with a gas producer known that their operating and renewal expenses are often prohibitive. It's all very well to figure their economy on paper, but what of the numerous vexations constantly cropping up in their actual operation, particularly if poor coal is used, be it soft or hard. To make a stab at operating a producer gas plant successfully means at least one spare producer and spare parts always in readiness for about every casting or piece of fabricated steel that is affected by the heat of the fire. These parts are not usually inexpensive.

The one item alone of the proper installation of the coal handling mechanism and its upkeep is staggering to think of and the ash-disposal, particuarly if the plant is located in a city where the ashes must be carted to an ash dump is no small task; it runs into money very fast. The quality of this gas varies amazingly, and, while the experts expatiate glibly on its properties and tremendous volume, there are times, my countrymen, when it makes **no gas at all**, to say nothing of its 125 to 150 B. T. U's, though I never saw the day when anything like 150 B. T. U's were in evidence from this gas.

To use producer gas for the melting of brass means that it must be preheated, and **that** little operation costs money. Then it must be pumped into the furnaces in tremendous volume without any hitch, and if it is to be successfully handled a line of piping from the city gas main is an ever ready friend in times of trouble to enrich the producer of gas when it more resembles ozone than gas.

The cheapest coal to use in a producer gas plant is the very best that money can buy, and my advice to anybody, who, in a moment of weakness, installs one, is to stick close to the anthracite variety, pea size of the highest quality. And at that you will live long enough to curse the day that you ever heard of a producer gas plant.

City gas at eighty cents per thousand cubic feet in the prewar days was reasonable enough in price and quality, but, nowadays, when its price has just about doubled and the quality, both as to candle power and B. T. U's, has reached a point where the users are all but compelled to light a match to find the flame, and the pyrometers freeze to death in attempting to record its heat, it becomes a very expensive means to use in melting brass. Most, if not all the figures quoted as authoritive as to the number of cubic feet necessary to consume in melting one hundred pounds of metal are very unreliable. Furthermore be it said, that the changing over from one fuel to another is not such an inexpensive proceeding as the victims are led to believe. It naturally follows that as the B. T. U's. contained in the fuels vary, the volume of gas as it enters the melting chamber also varies, which means some very radical changes. These are not always successful in operation, at least on the first go-off.

Not having had any experience whatsoever with electrical melting furnaces it becomes a painful duty to give the figures quoted as to their efficiency about the same credence granted to other means and no more.

Melting brass in electric furnaces resolves itself down in the final analysis, as to how much it will cost to make or buy the necessary current, taking it for granted that the renewal charges of burnt or worn parts will be no greater than the other types of furnaces.

Until cheaper power is available in all manufacturing centers, the universal 100 per cent adoption of electrical furnaces is as remote a possibility as the strict observance of the Volstead Act.

Marine Bronzes

Q.—I am taking the liberty of asking your opinion about the suitability of two brasses for use in the stern-bearing of a tank steamer.

The function of the bushing is to hold lignum vitæ strips. The sleeve bears upon the strips, a free circulation of sea water being provided for.

The analyses of the metals is as follows:

	Stern Bushing	Shaft Sleeve
Copper	56.52%	61.52%
Zinc	43.59%	37.93%
Lead	.....	0.27%
Magnesium	.....	0.05%
Aluminum	.....	0.30%

Photo-micrographs of the two metals are enclosed. That of the bushing is from a poor negative, but will show the general structure at the edges where the focus is best. (Magnification 33 diameters.)

The propeller shaft at 72 R. P. M. transmits about 2,800 horse power.

If you will, please say whether or not the metals described are suitable, and what, in your opinion, are the best metals for these two parts.

A.—The photo-micrographs and analyses of the Stern bushing and shaft sleeve indicate that they were probably cast from a commercial grade of manganese bronze. These parts are generally made of red brass and the compositions given below have given good service on an American Line vessel, viz:

	Stern Bushing	Shaft Sleeve
Copper	80.90	85.85
Iron	.51	.09
Lead	1.75	.65
Tin	6.64	10.74
Zinc	10.20	2.49

It will be found that red brass castings made of the above alloys are less affected by sea water than manganese bronze. The care used in mixing the alloys and their freedom from segregated areas that would act as galvanic couples may be taken as a measure of their resistance to corrosion.—J. L. JONES.

The Bureau of Mines is to study the commercial use of pyrometry in aluminum and aluminum-alloy melting practice. Data have been gathered as to the employment of pyrometric control of melting at commercial plants in the United States, and as to the types of pyrometers used.

Electro Plating Problems

Some Difficulties and Their Solutions

BRIGHT SILVER ON REFLECTORS

Q.—Will you please give me a good formula to obtain a lustre or shiny colored silver plating, without buffing or brushing, on auto lamp reflectors.

My silver solution consists of sodium cyanide and silver chloride. I have been advised to add bisulphide of carbon in order to get a shiny finish, so I did, but without better results. Now, they tell me to add some ether. Shall I do it?

A.—Bisulphide of carbon will be of little advantage in your silver solution in silver-plating the above articles. The silver deposited upon them by manufacturers is usually not any more than a film of silver.

The method for finishing reflectors is as follows: If made from brass, polish and buff to a high lustre, then cleanse with a good mild cleaner, wash in water, use a cyanide, then rewash in water, and nickel plate for a few minutes in a good nickel solution that will give a bright and white deposit. After nickel-plating just long enough to give a uniform coating of nickel, rewash in cold water.

Then silver-plate the reflectors for about two or three minutes in a solution prepared as follows:

Water	1 gallon
Sodium cyanide	6 ounces
Silver cyanide	1 ounce
Carbonate of potash	1 ounce

Use the solution cold with steel anodes at 4 to 6 volts. Replenish your solution with a stock solution made up of equal parts of sodium cyanide and silver cyanide. Add a little to your solution when the silver deposit becomes too thin. Always use hot water, as little as possible, to dissolve the sodium cyanide and silver cyanide.

After silver plating the reflectors as outlined, wash them in boiling water and dry them out. Then dry color them up on a soft buff, using lamp black mixed with kerosene oil to a paste, for the polishing medium, instead of compositions.

If you follow these instructions you will not need to use bisulphide of carbon as a brightener in your silver solutions.

Brighteners are prepared as follows:

Water	1 quart
Sodium cyanide	8 ounces

Make this solution first, using the water hot. Mix

1 ounce bisulphide of carbon
1 ounce sulphuric ether
¼ ounce water ammonia

Add these to the cyanide solution, mix thoroughly and allow to stand. Add only a drop or two to each gallon of silver solution. The above mixture would be ample for 500 to 1,000 gallons of solution.—CHARLES H. PROCTOR.

PLATING CUTLERY

Q.—Several months ago we communicated with you, asking for advice about the plating of cutlery, with silver, which gave us a great deal of trouble, in that such work generally peeled and blistered and was returned to us. We have held up attempting silver-plate knives, forks, and spoons, until such time as we install a new silver solution as per your suggestions to us in your answer. But now, however, we find that just about the same amount of trouble is going on with the nickel plating of knives, forks, and spoons, which we are still doing. We are unable to form an idea of what is the matter, except one, namely, that it is possible that successful plating of cutlery is only done with the "moving cathode" appliance, or the air agitated solution. Is this correct? Or can the successful and durable plating of knives in particular be done in a still solution with a motionless cathode?

So far as we are able to see, our work, mostly for private families, and some for hotels and restaurants, leaves the shop in O. K. condition, with not the slightest evidence of peeling. Then after several weeks or a month or two, complaints come in about the plating stripping off, "hanging in the butter," etc. We do not have complaints from all the cutlery jobs going out, but enough to make it a rather unprofitable business. Our solution is apparently neutral, neither the blue nor red litmus is affected. It stands at about 6½ Baume, and is not below 60 degrees F. Also take particular pains in cleansing in hot cleaner and scouring thoroughly after rinse; then a dip in dilute sulphuric acid dip, and give, without rinsing acid off, slight brushing again with scouring brush and very little pumice. Dip in same acid again, rinse thoroughly in clean water, and plate very slowly, so that entire tank filled up runs for 1½ to 2 hours, which produces a fine clear coat of nickel, without any burning, and buffs easily with a fine color. Note that our nickel anodes are somewhat fragmentary and worn down, and not having been bought new, we do not know how pure they may be.

Have you a receipt for any hot or cold dip or wash, in which to rinse cyanide plated articles, which after being dried and finished are to be lacquered? We note that fixtures brought here by local fixture houses are often stained and discolored under the lacquer, which we assume to be due to cyanide still remaining in the pin holes of the plated metal.

Regarding 24 K. gold solution, hot, which we are using for quadruple gold plating on church work, such as chalices, altar sets, etc., do you recommend the following formula as giving the most durable deposit, and at the same time with all the richness of color of 24 K. gold? We use all pure chemicals and 24 K. gold anodes, but have heard of the use of a very small amount of pure nickel in the gold to give it greater durability. The following is the formula which we use in making up the gold solution:

Distilled water per gallon.

Phosphate soda, 9½ ounces.
Bisulphite soda, 1½ ounces.
C. P. cyanide potash, ½ ounce.
Chloride of gold, 120 grains.

A.—In answer to your several questions covering trouble you experience in plating steel knives and forks with nickel, we are at a loss to understand why you have such trouble. Your cleaning method appears satisfactory. The trouble must be due to your nickel solution. Add ½ ounce sal ammoniac and ⅛ ounce muriatic acid per gallon of solution, and if possible slightly agitate the cathode pole or solution. Keep the temperature at 75 degrees to 80 degrees Fahr. As an additional precaution in the cleansing of the steel knives prepare an electro cleaner from sodium cyanide 96.98%, using cold water and steel anodes, and a strong current. After cleansing in this solution, wash in clean water and nickel plate direct.

Electro Cleaner.

Water	1 gallon
Sodium cyanide ..	8 ounces

Use a direct current as in plating. Please let us know the results you obtain from these suggestions.

We do not believe the formula you give for a 24 karat gold solution is as effective as a similar solution containing much less material. It would seem to us that 1 ounce of phosphate of soda would be more satisfactory than ½ ounce and ⅛ ounce bisulphite of soda instead of 1½ ounces. Why load up your solution with so much soda salts, when a little will give results?

Nickel hardens gold. Dissolve nickel cyanide in an equal amount of sodium cyanide 96.98%, using as little hot water as possible and add a small proportion to your gold solution. Avoid an excess or the deposit will become too brassy in color.—CHARLES H. PROCTOR.

ELECTROLYTIC DEPOSITION OF IRON FOR BUILDING UP WORN OR UNDERSIZED PARTS*

The electrodeposition of iron has been practiced for many years. During the war, the British Army repair shops developed a method for building up worn parts of automotive machinery, aero engines, etc., using the cold sulfate bath and low-current density method. The method has been used successfully in commercial work for the production of about 6000 repaired parts. Experiments along the same lines have since been made at the Westinghouse research laboratory.

As a result of preliminary work, the procedure recommended by Thomas was adopted. After the piece had been cleaned with gasoline or benzine, it was made the cathode in an alkaline bath containing about 5 per cent commercial lye and about the same amount of sodium carbonate, the exact amount being immaterial. A current density of 3 to 5 amp. per sq. in. was used. The piece was treated in this bath for 3 min. then it was washed in running city water and made the anode with approximately the same current density in 20 to 30 per cent commercial sulfuric acid for an equal length of time.

This process gave smooth, tough, adherent coats which, when deposited on carefully ground rod 0.485 in. in diameter and then ground to a thickness of 0.001 in. could be pressed through a hole in 1-in. cold-rolled steel 0.0005 in. smaller than the finished size of the rod, and then pressed back again with no signs of stripping.

A motor shaft having bearings ⅝ in. in diameter by 1½ in. long was purposely finished 0.002 in. small in diameter, plated oversize, reground and run in bronze bearings for 1000 hr. with a load of 50 lb. per sq. in. projected area, using a short stiff belt with a clipper joint in order to give a pounding effect as well as friction. At the end of the run it was found that the wear was 0.0002 in., which is just a trifle less than the original material shows in factory-life tests. Plug and thread gages have been repaired by this means and have given good satisfaction although they are not as hard as heat-treated tool steel.

Some work of N. B. Pilling, as yet unpublished, has shown that the brittleness due to occluded hydrogen may be completely removed by heating for ½ hr. at 300° to 400° C.

When cast iron is put through the electrolytic cleaning process, it emerges from the acid with a coating of graphite. It was thought that it would be useless to attempt to plate anything so covered with slime, but a cast-iron rod cleaned in the usual manner, covered with graphite and placed in the plating bath, was coated with entire success. Carefully ground test rods of cast iron were plated with a coating which, after grinding to 0.376 in., left 0.001 in. of coating and others were left after grinding with 0.010 in. of coating on a side. These were pressed through a hole in 1-in. cold rolled steel that was 0.0005 in. smaller than the finished size of the test piece, then pressed back again, but showed no tendency to chip or strip off. While it is usually cheaper to scrap standard cast-iron parts accidentally machined undersize, there are many cases where replacement of special parts would mean making new patterns and then casting, in which case the time and expense saved would amply pay for the necessary work of reclamation.—DAVID R. KELLOGG.

*Abstracted from a paper read before the A. I. M. E. in New York, February 22, 1922.

NICKEL ITCH†

MR. GEHLING. While we are on the nickel discussion, I wish to say that I have run into it pretty bad in regard to nickel solutions. I mean the nickel itch. I think it is something we will have to take up to protect our help. A number of helpers get nickel itch which should be prevented. It becomes very serious at different times of the year. From December on it seems worse. Naturally the ventilation of the room may have a whole lot to do with it. We had a cure for it, but that was only a cure for the itch. We should cure the cause. If there are any platers throughout the country that have anything to eliminate the cause, we might be able to save some of our help. All platers know that you cannot get the production out of a sick man as out of a well man. We have had trouble for the last four years. You cannot push production when you have to lay this fellow or that fellow off. Even if this same cure was applied you had to lay him off. Also different states refuse compensation because it is a vocational disease. You cannot get compensation for your help in most of the states, if they have nickel itch. Naturally it puts men out of work, but gets nothing for them. It seems to be getting to be a blight on the plating industry. The sooner we take it up the better for the plating industry.

MR. PROCTOR. The nickel itch does seem to occur more in winter than in the summer. Probably because we perspire freely in summer and the perspiration dilutes the salts. Two or three years ago a firm in New York wrote to me in regard to nickel itch. Their help had it severely and they had taken it up with a doctor who claimed it was blood poisoning. I took up the matter myself pretty thoroughly and worked out a formula. The formula was published in THE METAL INDUSTRY. It can be obtained from them on request. It works successfully. I think they will be glad to give it to you. Your men must follow it consistently, not use it for a day or two and then stop, but keep it up.

Chapped hands probably cause it very often, a thing one never has in the summer time. Some people's hands chap more easily than others, some do not have it at all. When the hands are chapped it can even be caused by putting the hands near a solution.

DR. MADSEN. I think what Mr. Proctor says is correct. At the refinery in Canada where they handle carloads of material and it is cold most of the time there is much suffering. Fumes like those of cyanide are absorbed entirely in the skin.

Do not permit men to use soap. If any salts are on the hands rinse with cold water first. **Do not use soap.** The proper treatment before going into the refinery is to rub the arms and hands with olive oil; rub it in. After that nickel salts will not be absorbed. Do not use soap and water.

†From the discussion at the Annual Banquet of the New York Branch A. E. S., February 18, 1922.

American Foundrymen's Association

Advance Information About the Convention to be Held in Rochester, N. Y., June 5-9, 1922

An extensive program of technical papers and reports has been prepared. The foundryman, specializing in any branch of the industry, will find much of interest in the program.

The coming convention will be of an international character, for besides the annual exchange paper of the Institution of British Foundrymen, which will be read by F. J. Cook of the British Institute, two papers are being contributed by members of the French Foundrymen's Association and one by the President of the Belgian Association of Foundrymen.

One session will be devoted exclusively to papers and reports of the joint American Foundrymen's Association and National Research Council Committee on Molding Sand Research. While the work of the Committee has only been carried through its preliminary stages, many interesting facts have been uncovered regarding reclamation of old molding sand and methods of testing sand, and this session should prove of great interest to all foundrymen.

The Industrial Relations session has been planned to feature foremanship, safety work and education of foundry workers.

As has been the custom for the past few years, a joint non-ferrous session will be held with the Institute of Metals division of the A. I. M. M. E. The A. F. A. non-ferrous session will be devoted largely to papers and discussion of the problems of the aluminum castings manufacturer. At this session it is hoped to bring together a large number of men interested in this new but increasingly important branch of the foundry industry.

An important part of several of the sessions will be the reports of the A. F. A. committees which have been working with the American Society for Testing Materials to better the standard specifications of casting metals.

In all, some forty-five papers have been secured for the eight technical sessions.

TENTATIVE PROGRAM

For the information of those who wish to make hotel reservations and arrangements for attending the Convention on days that will be of most interest to them, a tentative program for Convention Week is announced.

Monday—A. M., Opening of Exhibits. P. M., Joint General Sessions: A. F. A. and Institute of Metals Division A. I. M. E. Address of Welcome, Response, etc.

Tuesday—A. M. Gray Iron Session. P. M., Steel and Non-Ferrous Sessions.

Wednesday—A. M., Steel and Non-Ferrous Sessions. P. M., Industrial Relations Sessions; Evening, Annual Banquet.

Thursday—A. M., General Session: Molding Sand Symposium. P. M., Special entertainment features.

Friday—A. M., Malleable Session; final Business Session A. F. A. 5 P. M., Close of Exhibits.

SOME PAPERS TO BE READ

Flask Equipment for Molding Machines—by Arnold Lenz, Saginaw Products Co., Saginaw, Mich.

Electrically Heated Metal Patterns—by C. A. Cremer, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Investigations Relative to Insulated Core Oven Design and Performance—by C. F. Mayer, Ohio Body & Blower Co., Cleveland, O.

Belgian Method of Making Typewriter Frames—by J. Leonard, Liege, Belgium, President, Belgium Foundrymen's Association

Electric Cranes in Foundry Service—by A. H. McDougall, Whiting Corp., Harvey, Ill.

Accurate Control of Analyses in Acid Electric Steel Furnaces—by A. C. Jones, Electric Steel Co., Chicago, Ill.

Tests with Cerium as a Deoxidizer and Desulphurizer in Red Brass, Cast Iron and Converter Steel—by L. W. Spring, Crane Co., Chicago, Ill.

Impact Tests on Steel—by F. C. Langenburg, Watertown Arsenal, Watertown, Mass.

Research in The Foundry—by A. E. White, University of Michigan, Ann Arbor, Mich.

Technical Control of McCook Field Foundry—by E. H. Dix, Jr., McCook Field, Dayton, Ohio.

The Use of Secondary Metal in the Brass Foundry—by C. T. Bragg, Michigan Smelting and Refining Co., Detroit, Michigan.

Porosity of Non-Ferrous Metals—by R. R. Clarke, Pittsburg, Pa.

Aluminum and Aluminum-Alloy Melting Furnaces—by R. J. Anderson Bureau of Mines, Pittsburg, Pa.

Melting Aluminum for Rolling into Sheet—by J. A. Lange, Western Springs, Ill.

Use of Secondary Aluminum Ingot in Foundry Practice—by W. M. Weil, National Smelting Co., Cleveland, Ohio.

Two-Part Castings Made in Three-Part Molds—by W. H. Parry, Brooklyn, N. Y.

Eye Protection and Safe Clothing in the Foundry—by Buell W. Nutt, The Safety Equipment Service Co., Cleveland, Ohio.

Time Study Applied to Foundry Practice—by A. J. Kramer, Deering Works, International Harvester Co., Chicago, Ill.

Tests of Molding Sand—by R. J. Doty, Sivyer Steel Casting Co., Milwaukee, Wis.

The Significance of the Screen Tests of Molding Sand—by H. A. Schwartz, National Malleable Casting Co., Cleveland, O.

The Manufacture and Properties of Refractories for Air Furnaces—by C. E. Bales, Louisville Fire Brick Co., Highland Park, Ky.

Carbon Dioxide Recorders—by D. M. Scott, The T. H. Symington Co., Rochester, N. Y.

Technical School Foundries—by Prof. J. D. Hoffman and R. E. Wendt, Purdue University, Lafayette, Ind.

Exchange paper of The Institute of British Foundrymen—by F. J. Cook of the Institute of British Foundrymen. The subject of Mr. Cook's paper has not been received.

In addition to the above papers, there will be reports of the Association Committees which are co-operating with the American Society for Testing Materials, and the Committees on Safety Code, Pattern Standardization and Foundry Scrap.

COMMITTEE CHAIRMEN

The chairmen of some of the important committees of the American Foundrymen's Association are announced as follows:

Papers—Robert E. Kennedy, 909 West California street, Urbana, Ill.

Convention and Exhibits—W. R. Bean, Eastern Malleable Iron Co., Naugatuck, Conn.

Awards—G. H. Clamer, Ajax Metal Co., Philadelphia.

Foundry Costs—J. Roy Tanner, Pittsburgh Valve, Foundry & Construction Co., Pittsburgh.

Safety and Sanitation—Benjamin D. Fuller, Defiance Paper Co., Niagara Falls, N. Y.

Industrial Education and Training of Apprentices—C. B. Connelley, Department of Labor and Industry, Harrisburg, Pa.

Standard Pattern Practice—Vaughan Reid, City Pattern Works, Detroit.

Advisory to U. S. Bureau of Standards—Richard Moldenke, Watchung, N. J.

APPRENTICE TRAINING

The Committee on Industrial Education and Training of Apprentices of the American Foundrymen's Association headed by C. B. Connelley, has been asked to make a survey of the status of apprentice training in the foundry industry and to make recommendations as to how the Association can best assist in developing methods for training foundry workers. Much has been said in the past about the great need for trained foundry workers, but very little has been done by foundry managers to develop skilled mechanics.

The Committee has been making a study of the conditions in the foundry industry and also of the methods being employed in other industries to insure a constant supply of trained workers.

To assist the committee to formulate training programs intelligently, members are asked to fill out and return to the secretary a questionnaire giving their views as to the need for training apprentices in the foundry industry.

S. OBERMAYER COMPANY AWARD

At the Columbus Convention in October, 1920, the S. Obermayer Company caused it to be announced that they desired to contribute the sum of $1,000.00 as a gift to the American Foundrymen's Association, the interest therefrom to be used by the Board of Directors in making awards of a suitable nature to be given for some accomplishment or meritorious effort by workers in the foundry, the award to be in the nature of a handsomely engrossed certificate, a special trophy, or a cash premium, at the discretion of the Board.

This gift was formally accepted by the Board of Directors, and the Awards Committee announces that the conditions of competition for this year's award will be as follows:

This award which is known as the S. Obermayer Company Award, will be given to the person submitting a drawing or model of some jig or device which, in the opinion of the judges, embodies the best ideas for a device to help in the economical production of castings. The jig or piece of equipment for which this award is given shall not be patentable, but shall be such a device as can be constructed in any foundry and used in the production of castings, in coremaking, molding, pouring, or handling operations.

The models or drawings of the devices which are submitted in this contest will be on exhibition in a booth at the Exhibition Buildings during the annual convention of the Association at Rochester, N. Y., the week of June 5th.

Contestants for this award will be limited to men who are foremen or workers in foundries, or in some department of a plant operated in connection with a foundry, and they should file notice with the Secretary of the Association of their desire to contest, and receive further information as to conditions. In granting this award the judges will follow the general rules for granting awards laid down by the Awards Committee.

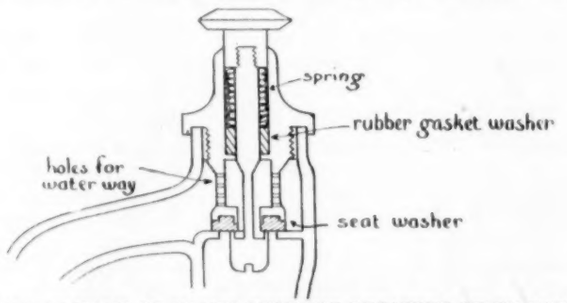
Members are urged to call attention of the men in their plants to this announcement, and to encourage competition.

Gaskets and Seat Washers

Q.—I am mailing samples of washers used by the firm I work for, and handled by me. They cause lots of trouble and the wash basin faucets they are used on have to be visited and washers renewed. On hot water faucets we use a small packing washer composed of fabric and rubber in layers and coated with graphite. It is the best my boss knows of but it is no good because the heat practically dissolves the rubber and causes a leak of course. Also the rubber cements onto the spindle when the faucet is not in use. Can you suggest a good washer for packing such work? Now the seat washer serves a double purpose as shown in sketch and although we have tried several firms, the washers are not what they should be—they swell and I am sure are not really waterproof. I think the water soaks through them. Can you suggest a good washer for this purpose?

A.—Use asbestos packing washers, coated with graphite. They will withstand a temperature of steam and work on hot or cold water faucets. Red fibre washers are not practical for use on high grade faucets for seat washers; they are only used on cheap grade brass goods. Use properly vulcanized rubber washers of high quality rubber on the seat. The cost of these is higher than that of the fibre washers, but you can get good wearing service from them, and can guarantee your faucets to give good service in hot or cold water. You can use a hard felt as a packing washer, lubricated by soaking in melted tallow at the correct temperature.

I have enclosed two sample seat washers suitable for your purpose. These rubber discs will stand hot or cold water; the hard one will stand up under steam. They cost more than the fibre discs, but they are 100 per cent better quality. They can be procured in different hardnesses and diameters, which go by numbers. We have also enclosed asbestos packing, which you can test out, and if possible let us know the results.—P. W. Blair.



CROSS SECTION OF VALVE SHOWING LOCATION OF WASHERS

If the inquirer will send us his name and address, we shall be glad to send him samples.—Ed.

Aluminum Analysis

The Bureau of Mines at its Pittsburgh, Pa., Experiment Station is conducting an investigation to devise a rapid commercial method for the direct determination of metallic aluminum in aluminum, aluminum alloys, drosses, etc. A hydrogen evolution method has been developed for the direct determination of the metal. A complete account of the study is being prepared for issue as a technical paper.

THE METAL INDUSTRY

With Which Are Incorporated

THE ALUMINUM WORLD, COPPER and BRASS, THE BRASS FOUNDER and FINISHER, THE ELECTRO-PLATERS' REVIEW

Published Monthly—Member of Audit Bureau of Circulation

Copyright 1922 by THE METAL INDUSTRY PUBLISHING COMPANY (Incorporated)

Entered February 10, 1903, at New York, N. Y., as second class matter under Act of Congress March 3, 1879

SUBSCRIPTION PRICE, United States and Canada $1.00 Per Year. Other Countries $2.00 Per Year : : SINGLE COPIES, 10 CENTS
Please Remit by Check or Money Order; Cash Should Be Registered

ADVERTISING RATES ON APPLICATION FORMS CLOSE THE FIRST OF THE MONTH

Palmer H. Langdon .....Editor and Publisher
Adolph Bregman .....Managing Editor
George W. Cooper .....Advertising Manager
Thomas A. Trumbour .....Business Manager

ADDRESS ALL CORRESPONDENCE TO
THE METAL INDUSTRY, 99 JOHN STREET, NEW YORK
Telephone Number Beekman 0404. Cable Address, Metalustry

Vol. 20 New York, April, 1922 No. 4

Contents

Motion Study in Metal Polishing..... 133
Experiments with a Wallmeter on the Process of Roughing.
By E. FARMER and R. S. BROOKE.

Casting Bronze 136
By W. J. REARDON

Meeting of the British Institute of Metals..... 137
Summaries of Papers Delivered at the Annual General Meeting in London, March 8-9, 1922.

The Grant Memorial 139

Some Cases of Failure in "Aluminium" Alloys.... 140

Recovery of Secondary Metals in Russia..... 141
A Description of the Methods in Use in Russia Before the Revolution .....By M. G. KORSUNSKY.

Influence of Cerium on Aluminum and Other Light Metal Alloys 142
A Description of Some Experiments With a View to Improving Melting and Possible Soldering of the Light Metals.
Translated by R. E. SEARCH.

Machining Aluminum 144
By P. W. BLAIR

Fuel Data on Brass Melting Furnaces..... 145
Are the Published Figures Reliable? How Are They Arrived at? The Disclosure of a Few Plain Facts to Prove That They Are Often Unalloyed Bunk .....By WILLIAM H. PARRY

Marine Bronzes 146
By S. L. JONES

Electro Plating Problems 147
Some Difficulties and Their Solutions.
Bright Silver on Reflectors .....By CHARLES H. PROCTOR
Plating Cutlery .....By CHARLES H. PROCTOR
Electrolytic Deposition of Iron for Building Up Worn or Undersized Parts .....By DAVID R. KELLOGG.
Nickel Itch.

American Foundrymen's Association..... 149
Advance Information About the Convention to Be Held in Rochester, N. Y., June 5-9, 1922

Gaskets and Seat Washers..... 150
By P. W. BLAIR.

Editorials 152
Manufacturers and Technical Societies.
Trade Associations.

New Books 153

Correspondence and Discussion..... 154
The Copper-Brass Merger.
How the Anaconda Company was Named.
Details of Plating Installation.
Institute of Metals Division Meeting.
Working Without a Plater.

Shop Problems 155

Patents 157

Equipment 158
Improved Plant for Making Rolls for Metal.
New Sheet Lead.
Welding-Torch Carrying-Case.
Low Pressure Air-Gas Inspirator.
Monadium Metal.
New Combination Machine Tool.
New Enamel.

Associations and Societies 160
Personals 161
Deaths 161
Trade News 162
Metal Consumption Statistics 169
Metal Prices 170
Supply Prices 172

EDITORIAL

MANUFACTURERS AND THE INSTITUTE

At the recent meeting of the Institute of Metals in London, England, Mr. Leonard Sumner, the chairman and managing director of the Broughton Copper Company, Manchester, England, was elected president of the Institute. His election was something of a departure from the usual practice, in that in the past a prominent metallurgist or engineer has been selected. At this time it was considered best that one who represented the manufacturers' part of the Institute should be chosen.

Mr. Sumner's address, which covered a number of topics including the growth of the Institute and the necessity for metal manufacturers and metal users to join the Institute, dwelt with considerable force on three topics: (1) The advances which had been made in works practice due to the more open policy of the manufacturers, and the fact that they were learning to share their information rather than to withhold it. (2) The need for standardized specifications for metals and metal products. (3) The need for training men for the metal industries in the proper fashion, taking into consideration the capabilities and tendencies of the men and the needs of the industry.

It seems that the Institute has effected a means of communication between competitors in the non-ferrous metal trades. At first there was dissatisfaction because of the unwillingness of manufacturers to co-operate, and to exchange ideas and experiences. Today, however, much of this has been broken down. According to Mr. Sumner, manufacturers are shown freely through their competitors' works. Also comparisons of methods, processes, etc., take place, and as a result all competitors are benefited. In this respect the Institute has done a very valuable work.

Mr. Sumner pointed out the difficulties of the manufacturer's position with regard to publishing papers. The fact that his primary interest was necessarily to earn dividends for his shareholders embarrassed him at times. He gave as an example a case in which a practical paper had been read before the Institute, giving the difficulties which the author had encountered in making a good article. The manufacturers present were called upon to reply, but none spoke up. The president then voiced the disapproval which seemed to be general thoroughout the meeting. Later Mr. Sumner spoke with one of the manufacturers asking him for his reasons for not contributing to the discussion. His answer was that his firm had already solved the trouble, and as a result had obtained all the business for the article in question. He was therefore, unwilling to give up the information to their competitors. This was simply one instance of the extremely upleasant situations in which manufacturers might find themselves.

Mr. Sumner spoke of the difficulties also experienced by metal users, who were flooded with proprietary alloys. This situation is, of course, understood very well in the United States, where trade names have made it almost impossible to keep up with the market. He stated that, "the time is coming when no 'Jones' Metal' or 'Smith's Bronze' will be accepted by the user unless the manufacturer is prepared to lay his cards on the table, and say at once of what his alloy consists. The alloy may be called any name one likes, but its constituents should be stated, and the maker should be prepared to stand or fall with the metal he puts on the market."

As regards the training of metallurgical students, Mr. Sumner classified them very aptly as follows:

1. The man whose bent is research.
2. The man who takes a keen interest in works practice, and is able to handle other men.
3. The accurate, faithful detail worker.

The first of these three, the research man, was useful for his originality and because his work resulted in improvement of the product. He was the seeker for something new and therefore valuable, in fact in many cases indispensable, "although sometimes a bit of a luxury."

The second type, the producer or works manager, is, of course, the most attractive to the executive. He is the man who "gets out the work."

The third is the routine worker, perhaps accurate and faithful, but who cannot go on without direction from above.

As was natural Mr. Sumner made a plea for the man of the second class, probably with the idea of obtaining for him a little more recognition from the Institute. He made his position quite clear with the statement, "Sometimes I am inclined to think that our teachers are prone to be too much interested in the brilliant student, to the possible neglect of the student who is not so clever. They seem to overlook the fact that industry requires many sound and able men and but few brilliant men."

He closed by giving hope for the future, and expressing the belief that the prosperity of the industry and the Institute were bound together.

TRADE ASSOCIATIONS

During the last six or eight months, much has been said and written about trade associations. The Lockwood investigations in New York State have uncovered criminal acts resulting in the dissolution of a large number of these associations. The business men who form them, however, have declared that organizations of this sort are absolutely necessary to stabilize their industries and to help them to conduct their business with the proper amount of foresight.

The matter has been taken up by Secretary Hoover, with the idea that trade associations are a necessary adjunct to business, and that if properly managed and under adequate control, they can be kept within the law and at the same time perform a valuable service to their membership. To ascertain their rights Secretary Hoover addressed a letter to Attorney-General Daugherty, asking a number of questions among which were the following:

May a trade organization provide for its members a standard or uniform system of cost accounting?

May a trade organization advocate uniformity in trade names; standardization of quality and grades of product; standard form of contract for correctly designating the standards of quality and grades of product; standardized technical and scientific terms; standardized processes and production methods?

May a trade organization collect information as to financial responsibility, etc., of the customers of the members of the association? (In other words, may it become a credit bureau?)

May a trade organization arrange for handling the insurance of its members, of all sorts, such as fire, industrial, indemnity, etc.?

May a trade organization engaged in co-operative advertising, furnish standard labels, designs and trade-marks, engage in promotion of welfare work, such as sick benefit, unemployment insurance, trade education, safety work, and employment departments, etc.?

May a trade organization handle legislative questions and railroad rate questions?

May a trade organization collect statistics from each member, showing his volume of production, capacity to produce, wages paid, distribution of his product, this information to be collected by the association, compiled into a report, filed with the Secretary of Commerce for distribution by him to the members of the association and to public generally, through the press or otherwise?

May a trade association also report the prices they receive for the products specifying volume, grade, brand, style, quality, etc., this information also to be compiled by the association and filed with the Secretary of Commerce for distribution?

To these questions the Attorney-General replied that there was no objection to a standard system of cost accounting, but that associations should be warned against uniform cost as to any item of expense. Furthermore, it seemed to him doubtful whether associations should furnish trade labels, designs and trade mark for their members, since the inevitable result of uniformity of advertising matter and trade marks between competitors would be uniformity of prices. The attorney general saw nothing illegal in the exercise of the other activities mentioned, provided that nothing which was done would be used as a scheme to curtail production or enhance prices which would suppress competition. He stated that it was impossible to determine in advance just what the effect of a plan when put into operation might be, and that while many things might seem lawful on paper the results in actual practice might be unlawful.

It seems, therefore, that trade associations have a real purpose and a right to exist, but that they are easily mishandled and must bear careful watching. As organizations for obtaining statistics of trade conditions to keep their members from committing commercial blunders, and to keep them thoroughly in touch with the market, they are essentially lawful. Moreover, it seems from the above correspondence that it is legitimate for them to divulge their prices through the Secretary of Commerce, providing that this procedure is not used as method of enhancing these prices and restricting trade. Just how this is to be worked out is not stated. It is very plainly a difficult matter.

On April 12th a conference will be held with Secretary Hoover, and the representatives of National trade organizations in Washington. The object will be to secure a list of trade associations that will (1) Furnish voluntarily to the Department of Commerce the classes of statistical information outlined in the correspondence between the Department of Commerce and the Department of Justice: (2) Discuss and consider means for collecting and forwarding to the secretary, for dissemination, the information referred to; (3) Discuss the manner in which such reports are to be filed with Department of Commerce and the method of distributing the information to the members of the associations and to the public. The meeting will be full of interest for all business men, since it may lay down standard rules under which they can operate without getting into difficulties with the Department of Justice.

NEW BOOKS

Journal of the Institute of Metal. Edited by G. Shaw Scott, M. Sc., Secretary. Published by the Institute of Metals, London, England.

This is volume 26 of the Journal of the Institute of Metals. The book contains, in addition to the minutes of the proceedings and abstracts of papers relating to metals and the industries connecting therewith, a number of papers, presented at the past year's meetings. Abstracts can be found, in the 1921 issues of THE METAL INDUSTRY, of the papers which are as follows:

The Casting of Metals.
The Properties of Some Nickel-Copper-Aluminum Alloys.
The Effect of Increasing Proportions of Lead Upon the Properties of Admiralty Gun Metal.
The Casting of Brass Ingots.
The Density of Copper Zinc Alloys.
Experiments in the Working and Annealing of Copper.
The Effect of Progressive Cold-Drawing Upon Some of the Properties of Low-Tin Bronze.
The Extension Defect.
The Use of the Scleroscope on Light Specimens of Metals.
The Relation Between Mechanical Properties and Microstructure in Pure Rolled Zinc.
The Constitution and Age-Hardening of the Alloys of Aluminum with Magnesium and Silicon.
The Electrolytic Etching of Metals.
The Magnesium Alloy "Electron."
Notes on the Corrosion and Protection of Condenser Tubes.

Materials of Construction, by the late A. P. Mills, edited by Harrison W. Hayward. Published by John Wiley, New York. Size 6" x 9". Illustrated. Price $4.00, payable in advance. For sale by The Metal Industry.

This is the second edition of the work first published in 1915. It was an outgrowth of the lectures and notes for the College of Civil Engineering, Cornell University.

The most interesting chapter in the book to those working with metals is the one on Non-ferrous Metals and Alloys. The production, properties and uses are covered concisely and clearly, giving an excellent idea of the position of these metals in commerce and industry.

The book is useful to every engineer, of course, and should form a part of every good technical library. It is also useful to the metallurgist, giving him a clear idea of where his products go, how they are used and what is required of them.

Year Book for 1921 of the National Association of Cost Accountants, published by the N. A. C. A., New York City. Size 5¾ x 8¾, 398 pages. Price $3.00 payable in advance. For sale by THE METAL INDUSTRY.

Although at the first glance this volume seems to have little in it of direct use to metal manufacturers, a further examination leads to a decided change of opinion. The papers delivered at the second International Cost Conference at Cleveland, September 14-16, 1921, which are reprinted in full, with discussion, brought up a number of points of great value to the metal trades. Symposia were held on the following topics:

Cost Systems as a Means of Preventing Wastes.
Uniform Methods and Standardized Costs.
The Distribution of Overhead under Abnormal Conditions.
Interest as an Element of Cost.

A number of the papers under these four topics deal with machinery and machine manufacturing, such as, automobiles, etc. The principles laid down should be practically applicable to metal manufacturers.

It has been growing on the metal trades that one of the things which must be changed before conditions throughout the trade can improve permanently is the present lack of an adequate standard cost system. This defect can not, of course, be remedied in a day, but it will pay to obtain these Proceedings and to read them. The ideas gained will help in the development of the type of system necessary.

CORRESPONDENCE and DISCUSSION

Although we cordially invite criticisms and expressions of opinion in these columns, THE METAL INDUSTRY assumes no responsibility for statements made therein.

THE COPPER-BRASS MERGER

To the Editor of THE METAL INDUSTRY:

I have seen in your paper several articles as to the selling out of the American Brass Company to the Anaconda Copper Mining Company and some of them seem to feel that it will be up-hill work to compete with this organization unless other brass companies do likewise.

Now I am quite sure such is not the intention of Anaconda Company, and their statements when the deal was proposed was clear and plain, as a business proposition in every respect. None of the brass mills, large or small, need have any fear of being put out of business by them if they will go ahead and saw wood in their own back yard and not do too much talking and price-cutting. All brass interests know that the American Brass Company has been the leader in price-making and has not bothered about what others did, or the prices they made. See what returns stockholders received in dividends and in the close-out sale. This is the result of their policy of keeping good men, and a plain, straightforward, practical system of doing business; no "experts," few changes and men they have trained themselves.

The greatest trouble with some companies are they have too many "experts," "managers," "purchasing agents," "sales managers," and "expert cost systems," installed by theorists. They make figures which result in nothing; then they get a new set, with not better results, or even worse in many cases. I have figured costs in the past and know that one man, who knows what he is doing can get more satisfactory results, which will count at the end of the year when your inventory is made up, than a cow-pen full who figure and do not know what they are doing. Drawing their pay is their main object.

Now in conclusion I wish to say that Mr. Charles F. Brooker, the man who conceived, organized and made the American Brass Company what it was, stands at the head, and will go down in history at the top of them all for plain simple systems, and the greatest success of them all, for those who trusted their money with him in the brass business.

"The race is not always to the swift
Or the battle to the strong."

New York, March 15, 1922.

THOMAS R. TAYLOR.

HOW ANACONDA COMPANY WAS NAMED

To the Editor of THE METAL INDUSTRY:

Wherefore the name Anaconda?

I note Mr. Kelley's explanation as to the origin of the name of the mine owned by his company. There is no doubt but that the name was given by Michael A. Hickey. How it happened that Hickey hit upon the name of a reptile with the physical appearance of which, from the standpoint of a naturalist, he was probably unfamiliar is of interest. The story as I remember it from the time when the wonders of the mine and the uniqueness of the name were matters of general discussion, is as follows:

Hickey was a soldier in the Army of the Potomac and took part in many of its important battles. The word "anaconda" came into American speech when it was applied—I think by the New York Herald—to McClellan's Army which, "anaconda-like," was expected to encircle the Rebellion in its folds and crush out its life. Every soldier in that army became familiar with the word "anaconda" and was interested in knowing the physical characteristics of the creature.

Hickey, with the sympathetic imagination of his race, had a fondness for names with associations, as was evidenced when he named another mine, the St. Lawrence, from the county of his birth in New York state.

The identification of the name Anaconda with the stirring times of an historic army in a great human drama is a sentiment worthy of preservation.

Los Angeles, Cal., March 14, 1921.

GEORGE J. BURNS.

INSTITUTE OF METALS DIVISION MEETING

To the Editor of THE METAL INDUSTRY:

I have read the March number of METAL INDUSTRY with a great deal of interest, and want to compliment you on the way you have reported the Institute of Metals Division Session, also on your editorial. It certainly is a great help to have the co-operation of a paper like yours for this kind of work.

New York, March 13, 1922.

W. M. CORSE.

DETAILS OF PLATING INSTALLATION

To the Editor of THE METAL INDUSTRY:

I read the above article by Charles H. Proctor in the February issue and he covered the subject in very good form. I desire to take exception, however, to his answers to Nos. 7 and 8.

No. 7. Question.—These tubes will have a fine thread ½-30 for a distance of 5/16" on both ends. Would it be feasible to plate, then thread and then color these tubes? **Answer.**—Yes. I wish to take exception to the answer "Yes" as it is not practical. These lengths of tubing should be cut off and threaded before plating, as in threading after plating they are likely to be scratched and otherwise disfigured; also, there is extra handling and moving back to the brass machine department to be threaded on ends and then returned to buffing department to be colored after threading.

No. 8. Question.—Is plating hard on dies and tools and does threading after plating tend to curl up the plating? **Answer.**—If deposit is perfectly adherent, such results will not occur.

Threading after plating has a tendency in some cases of making the nickel peel or curl at that point. It also makes a bad appearance as plated work, as these tubes have to screw into a connection and there will be a tendency of some of the threaded ends of tubes not to screw up the full distance, and thus allow that part to show. This would make the job fail to pass inspection.

I must commend Mr. Proctor on the entire set of questions, however, and the manner in which he covered them.

Montreal, Canada, March 15, 1922.

PETER W. BLAIR.

WORKING WITHOUT A PLATER

To the Editor of THE METAL INDUSTRY:

I am desirous of obtaining information from you, regarding some finishes.

I am employed by a small concern out West and my employer is trying to dispense with the services of a plater through the information obtained from your Journal; therefore the above question.

March 14, 1922.

PLATER.

We shall be pleased to answer your question regarding finishes that you may submit to us.

If your employer has an idea that he can dispense with the services of a practical plater by merely depending upon The Metal Industry for information and advice, it might be advisable for him to try his scheme once. He would never repeat it.

The Metal Industry is for platers or plating concerns who seek advice covering methods or finishes that they are not always familiar with, but a formula in itself amounts to very little unless the operator possesses the experience and practical skill to get the desired results from the solution.—C. H. P.

SHOP PROBLEMS

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE

ASSOCIATE EDITORS { JESSE L. JONES, Metallurgical; WILLIAM J. REARDON, Foundry; PETER W. BLAIR, Mechanical; LOUIS J. KROM, Rolling Mill; CHARLES H. PROCTOR, Plating-Chemical; R. E. SEARCH, Exchange-Research.

CASTING GOLD IN SAND

Q.—How can I cast gold in sand?

A.—I have not been able to find references on casting gold into sand molds. Gold has from time immemorial been cast into chill molds, and owing to the hydrostatic pressure of molten gold, I can clearly see the objection to pouring into sand. I have frequently observed the tendency for fluid gold to penetrate fire brick joints and fire brick also. in the case of a broken crucible where the furnace vent was not of sufficient area to carry away rapidly the flow. I can see no advantages to counteract the many disadvantages of molding gold in sand. H. D. C. Problem 3,059.

CLEANING ALUMINUM

Q.—What is the correct strength for caustic soda and acid used in cleaning aluminum?

A.—In cleansing aluminum before acid dipping in nitric acid the following solution should be used:

Water	1 gallon
Caustic Soda	3 ounces
Soda Ash	2¼ "
Water Glass	1½ "

Temperature 180 deg. Fahr.

After immersing the articles in the cleanser for a few moments, the surface will darken. Then remove, wash in cold water and immerse in undiluted nitric acid 38°. Or, two parts nitric acid and 1 part sulphuric acid 66° may be used.

The acids have but little reducing action upon the aluminum. They merely reduce the oxide of aluminum resulting from cleansing and leave the base metal white and clean. C. H. P. Problem 3,060.

COPPER AND BRASS PLATING

Q.—I have a copper plating tub in which I plate only zinc tips. I have been informed that if I continued to run it, it will plate brass. Is this a fact?

A.—In copper plating zinc corset steel tips in a copper plated tub, it might eventually ensue that the zinc tips would receive a brass deposit due to the reduction of zinc oxide, that is possibly present on the inside of the zinc tips. But this can be avoided if you use a hot copper solution, say 140 to 160 deg. Fahr. in temperature, and occasionally add a little bisulphite of of soda to the copper solution. If you heat up a brass solution it will deposit bronze and frequently copper. When brass does commence to deposit, then heat up the solution and add the bisulphite of soda as outlined. C. H. P. Problem 3,061.

COPPER 50, LEAD 50

Q.—In question 3016 (December, 1921, page 492) where you state that in using an alloy of 50 copper and 50 lead one should devise a method of casting a thin lining of this alloy in a cast iron shell. I would like to know what this lining is used for and how I may obtain a shell to try same. Also what purposes this alloy can be used for besides packing rings.

A.—The alloy of copper 50 and lead 50 is a very superior antifriction metal and it has a very much higher melting point than ordinary babbitt. It combines many of the good points of both a bearing bronze and a babbitt. For bearing purposes, however, it would require the support of a cast iron or steel shell. Many users of bearings would no doubt be glad to furnish a sample shell to be used for experimental purposes.

Besides packing rings the alloy of copper 50 and lead 50 is claimed to be used as an anti-acid metal. Its value as an acid-resisting metal would, in the writer's opinion, depend in a great measure on whether a uniform alloy was secured or not. J. L. J. Problem 3,062.

COPPER SHEET SCALES

Q.—How can I keep the tin coating from scaling off copper sheets? I am sending samples to show you how the tin comes off.

A.—The samples of tinned copper stampings have been received. From the fact that the tin appears to adhere perfectly to a large portion of the surface and is only scaly in spots, it looks as though the copper was not properly cleaned before the tinning operation. Try cleaning some of the copper sheet so that when it is dipped in water an apron of water will be formed evenly over the whole surface; tin this piece to see if it is an improvement over the regular work. Care should be taken to get no finger marks upon the surface of the cleaned sheet. Above all else have the surface of the metal clean before attempting to tin.

Copper articles such as chafing dishes, etc., are sometimes tinned as follows:—First wipe them with a chloride of zinc flux evenly over the whole surface, then place a small piece of lump tin in the dish. Hold the dish over a gas flame until the tin just starts to run; now rotate the dish with the two hands until the tin is spread over its entire surface; then wipe out with tow in the usual manner. If this operation is carried out skilfully it will be hard to tell the tin plate from nickel plate. P. M. T. Problem 3,063.

CORE MIXTURE

Q.—We have trouble getting the cores out of valve bodies and other plumbing fittings and would ask you to kindly give us formula for sand and core oil or binder for cores that will blow out of these fittings.

A.—A very good core mixture used by brass valve makers, and other plumbing fitting manufacturers, is 60 parts of sharp sand, ocean or silica sand preferred, 20 parts of old molding sand, and 1 part of raw linseed oil or any proper core oil, and 1 part of goulac core binder, or molasses water can be used.

Another mixture used is 2 parts of sharp sand, 1 part molding sand, and for each 70 parts of sand use one part of dextrin and 1 part of any good core oil. Be sure to add the oil first. W. J. R. Problem 3,064.

CUTTING DURALUMIN

Q.—We are interested in receiving information as to the sawing of Duralumin or other aluminum alloys. We are particularly interested in the saw blade for cutting this material and would like to know the number of teeth per inch, and the speed and shape of tooth that is most desirable for quick cutting and reasonable upkeep of such a saw.

A.—The saw that we found to be the best for cutting this material is the band saw which runs 2,500 feet per minutes. The wheels on the saw are 30" diameter. The saw is direct driven and the pulleys on the saw are 12", and on the line-shaft 18". This runs 350 revolutions per minute. The saws used are ¾" in width, and gage No. 21. Use six points to the inch. This saw always gives the best results for cutting such material.—W. J. R. Problem 3,065.

DRILLING GLASS

Q.—How can I drill 3/16" holes in ¼" plate glass?

A.—Glass can be readily drilled by using a drill made of high speed steel using as a compound turpentine and camphor.

Run the drill at a fast speed and feed lightly.

Grind the drill with a long point or angle and plenty of clearance.

Your trouble must have been in the drill and how it was ground. With a hard tempered properly ground, glass can be drilled from 1/6" to ½" in thickness, about as rapidly as cast steel. P. W. B. Problem 3,066.

FOAMING NICKEL SOLUTION

Q.—My nickel solution gives trouble by foaming. It is a single salt solution and stands about 15.

A.—The foaming of your nickel solution would indicate that it is alkaline.

Add from ⅛ to ¼ ounces of pure muriatic acid per gallon of nickel solution. Then add one ounce or more sal ammoniac per gallon.

Make a test on a 10 gallon basis. If the results are satisfactory, then treat your nickel solution accordingly If the peeling still continues, then procure some sodium fluoride and add from ½ to 1 ounce per gallon of your solution. C. H. P. Problem 3,067.

GREEN ON BRASS

Q.—How can we get a green finish on brass like the enclosed sample?

A.—It is essential that the casting be of rich green brass. It is then cleaned by pickling, bright dipping, and then sand blasting. The next step is to oxidize to a dark brown tone, similar to statuary bronze, by the following method:

Use a solution of

Water	1 gallon
Potassium Sulphuret	1 to 2 ounces
Caustic Soda	6 ounces

Immerse in this solution to darken, rinse, and set color in sour water, i. e., 10 to 20 per cent solution of sulphuric acid and water. If necessary scratch brush, and repeat. Then give a light sandblasting, using a fine or sea sand variety, at low pressure, after which the articles are spray-lacquered, and toned down with a wax paste of which a very thin coat is to be applied.

FORMULA FOR WAX.

Dissolve beeswax and paraffine wax in turpentine to a thin paste, and add just enough chrome green and burnt umber to produce a slightly olive tone to the wax. It is applied by brushing with a hand brush. J. A. S. Problem 3,068.

IRON ARSENIC—NICKEL FORMULA

Q.—What is the formula for the iron, arsenic and nickel combination?

A.—The formula for the arsenic, nickel and iron combination is as follows:

Muriatic Acid	1	gallon
White Powdered Arsenic	4	ounces
Chloride of Iron	4	"
Nickel Chloride	4	"
Water	1	quart

Dissolve the arsenic in about 1 quart of acid by the aid of heat; then add to the balance of the acid.

Dissolve the chloride of iron in 1 pint of warm water, and add to the acid. Dissolve the nickel chloride in the same amount of water and add to the acid. Mix thoroughly and use the solution cold.

Use anodes of nickel or carbon. As the solution will color brass by immersion it is advisable to just whiten over the brass with a thin white deposit of nickel. If the black is for relief work, the white nickel will have to be omitted as it would produce too hard a surface to cut through to the brass. Use your own judgment in the matter. C. H. P. Problem 3,069.

LACQUERING WITHOUT CLEANING

Q.—I do a large quantity of brass work in brush brass finish. I clean the work after brushing and before lacquering. I have tried different combinations to make a brush brass composition so that I can lacquer the work direct from the wheel without cleaning, but without success. Can it be done?

A.—I have heard that the brush brass finish is lacquered immediately after leaving the wheel. However, this must be a dry finish and presumably done by the aid of canvas wheels emery coated. Wet pumice or anything of a greasy nature could not be used, because drying and cleaning would have to be done to obtain a surface satisfactory for lacquering.

The writer used to finish push-button plates and floor plates and similar goods by the dry finish, and lacquer them directly. The only other method that in our opinion could be used would be the sand buffing method, which is used in buffing britannia metal. Windsor Locks sand is used dry and put on the brass articles like pumice stone mixed with water. A tampico or cloth buff is run over the articles, the sand being just abrasive enough to give the dull finish. You might try this method. The sand being dry, an air blast would remove any dust on the articles. This could be done in connection with spray lacquering. C. H. P. Problem 3,070.

LEAKY VALVE CASTINGS

Q.—What can we do to eliminate our trouble in making some of our castings stand steam pressure? We use 88 copper, 10 tin, 2 zinc and ½ of 10% phosphor copper. The valves, about ¼" thick, leak through the body. Also what is a good facing for No. 2 Albany sand?

A.—I would say that your trouble is very evidently in the melting and handling of the metal, as your castings are heavy, and to prevent leakage under the pressure I would suggest that you make a hardener of 50% copper, and 50% tin, and pour into ingots and use as follows:

Melt 78 parts of copper, use a charcoal covering, and add the phosphor copper, then 20 pounds of the hardener (50 copper and 50 tin) then add the zinc and stir well. Then add a small spoonful of salt. In melting the copper keep well covered with charcoal and pour your castings about 2,000 degrees Fahr. If your melting is done properly you should have no further trouble with leakage.

The best facing for green sand molding is to shake flour on your mold and blow off clean. No. 2 Albany sand is very good sand for green sand molding. W. J. R. Problem 3,071.

METAL FOR DRIP POCKET

Q.—We are figuring on making a steam fitting called a drip pocket. This fitting must stand 250 pounds steam working pressure with 100 degrees super-heat.

We wish to know if manganese bronze is a suitable material from which to cast these; also if a material listed in Kent's Mechanical Engineers Pocket Book as Gun Metal, with a composition of 88 copper, 10 tin, 2 zinc, is a suitable material for this work.

A.—The alloy best suited for this class of work, and one that has given good results in super-heated steam valves, consists of 85 per cent copper, 10 per cent tin, 5 per cent nickel, and 2 per cent zinc, to be made as follows: Make a hardener of 50 parts tin, and 50 parts nickel; pour into ingots, after which use as follows: Melt 83 parts copper under charcoal, and add 4 ounces of 30 per cent manganese copper as a flux. Then add 10 pounds of hardener; stir well; add 5 parts tin; stir again; add 2 per cent zinc, and pour at about 2,100 degrees Fahr.

Another alloy employed for this work consists of 86 per cent copper, 13 per cent tin, and 1 per cent zinc. This alloy will stand hydraulic pressure of 5,000 pounds per square inch, and is said to give much better results than 88 per cent copper, 10 per cent tin, and 2 per cent zinc, for super-heated steam. Manganese bronze is not suitable for super-heated steam work. W. J. R. Problem 3,072.

PINION BRONZE

Q.—Will you kindly give me what you consider the best formula for phosphor bronze for heavy pinions.

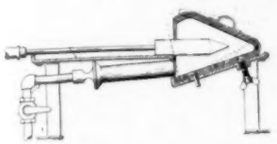
I wish to use 10 per cent phosphor copper and melt in a barrel type air-oil furnace. Any suggestions you may have to offer will be appreciated.

A.—One of the best formulas for phosphor bronze pinions is the old English Gear Bronze mixture, which consists of a mixture of 85 per cent copper, 11¼ per cent tin, 1¼ per cent lead, ½ per cent zinc and 3 pounds of 10 per cent phosphor copper. The best results are obtained when the metal is melted, then poured in ingots and remelted for castings. W. J. R. Problem 3,073.

PATENTS

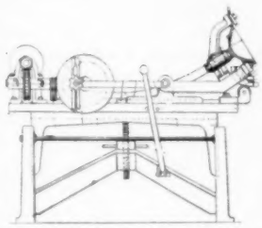
A REVIEW OF CURRENT PATENTS OF INTEREST

1,401,514. December 27, 1921. **Soldering-Furnace.** James Blake, of Buffalo, N. Y.



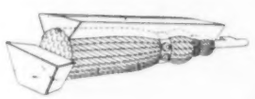
One object of the invention is the improvement of the flame-chamber or hood of the device which receives the soldering iron or irons, with a view of utilizing the flame to the fullest extent and heating the irons in a comparatively short time.

1,401,563. December 27, 1922. **Metal-Burnishing Machine.** William B. Smith, Norwood, Ohio.



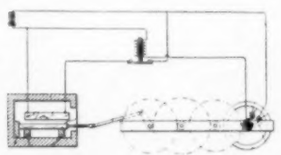
This invention relates to a machine for retaining a concave or hollow piece of ware, of any character which is to be burnished, as by the passage of a revolving brush or the like over the inner surface of such hollow article. Among other articles which may be burnished on this machine, are the concave reflectors of automobile lamps, and the plan shown in the drawings is of a machine specially adapted for doing this work.

1,401,577. December 27, 1921. **Art of Molding.** Sylvester Becker, of Rutherford, N. J., assignor to Sterling Bronze Company, of New York, N. Y., a corporation of New York.



The object of this invention is the formation of molds rapidly, economically and accurately without resorting to skilled labor, such molds being especially adapted for the production of cast objects with the surfaces more or less in intaglio. By this procedure, the production of false molds is done away with, and castings are made rapidly and accurately from molds the sand of which is formed in accordance with this invention.

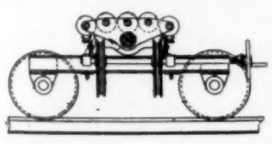
1,402,722. January 3, 1922. **Apparatus for the Heat Treatment of Metals.** Lyman C. Josephs, Jr., of Allentown, Pa., and Gottfried Wirrer, of Plainfield, N. J., assignors to International Motor Company, of New York, N. Y.



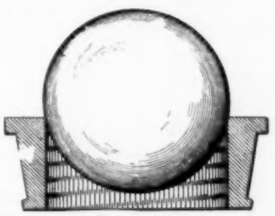
In accordance with the present invention the metal under treatment during expansion at the normal rate causes one element of the controlling device to move with another independent element of the controlling device which is itself moved at a uniform rate by independent means, whereby, as the metal passes through its critical point and its rate of expansion is reduced, separation between said two elements will occur and thereby the change in the heat treatment will be initiated.

1,402,551. January 3, 1922. **Means for Feeding Goods into and Removing Goods from Annealing and Other Furnaces.** Martin Van Marle, of Lower Gornal, England.

This invention comprises improvements in or connected with means for feeding metal goods or other goods into annealing and other furnaces and for removing such goods from said furnaces. This invention is of that type which comprises a goods carrying carriage adapted for longitudinal movement and arranged so as to carry the goods bodily into the furnace and to lower and deposit them on to the furnace bottom or on to rails or supports thereon and then to return out of the furnace, said goods carriage being carried by a traveler adapted to travel along rails or the like outside the front of a furnace or a battery of furnaces so that the same feeding and charging device will serve for any of the furnaces.

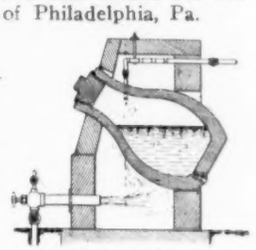


1,402,508. January 3, 1922. **Process of Manufacturing Metal Rings.** Marcus T. Lothrop, Ohio, assignor to the Timken Roller Bearing Company, of Canton, Ohio.



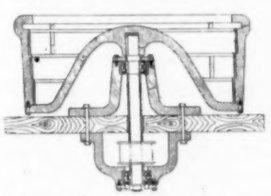
This invention relates to the manufacture of metal rings and tubular articles, and has for its principal objects to simplify and cheapen the process of manufacturing such articles and to make them with a more accurately formed and highly finished bore than is practicable by other processes. The invention consists principally in forming the bore with a roughly circular cross section of substantially the diameter desired for the finished article and obliterating the irregularities by forcing endwise thereof a plug of circular section and of a diameter very slightly larger than that desired for the finished bore.

1,403,349. January 10, 1922. **Method and Means for Refining Metals.** Herbert M. Shimer, of Philadelphia, Pa.



Heretofore the refining of aluminum, zinc and similar metals and alloys thereof and especially in reclaiming aluminum from borings and other waste arising from machine work upon castings or other worn out castings, etc., has been attended with imperfect results and very considerable loss owing to the freedom with which they oxidize and volatilize, and it is an object of this invention to eliminate these objectionable results and thereby not only insure great saving by increasing the quantity of the recoveries, but also obtaining a cleaner and purer product as a result of the improved process.

1,403,347. January 10, 1922. **Centrifugal Casting Machine.** Albert F. Rockwell, of Bristol, Conn., assignor to Marlin-Rockwell Corporation, of New York, N. Y.



A centrifugal casting-machine comprising: a rotatable mold member having a circumferential rim, a plurality of annular casting grooves formed along the inner face of said rim in an outwardly stepped relation from the lowermost to the uppermost groove, and means in each groove for forming a break in the length of the casting formed.

1,403,083. January 10th, 1922. **Manipulator for Feed Tables for Rolling Mills.** Clinton H. Hunt, of Steubenville, Ohio.

The object of this invention is to simplify and make more direct and effective the means for turning ingots, blooms, billets, slabs, or the like, upon feed-tables. This object is secured by providing a mechanism with fewer moving parts and consequently lighter moving masses than are known for accomplishing similar results. The power required for overcoming the inertia of motion and rest is correspondingly reduced in the invention.

EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

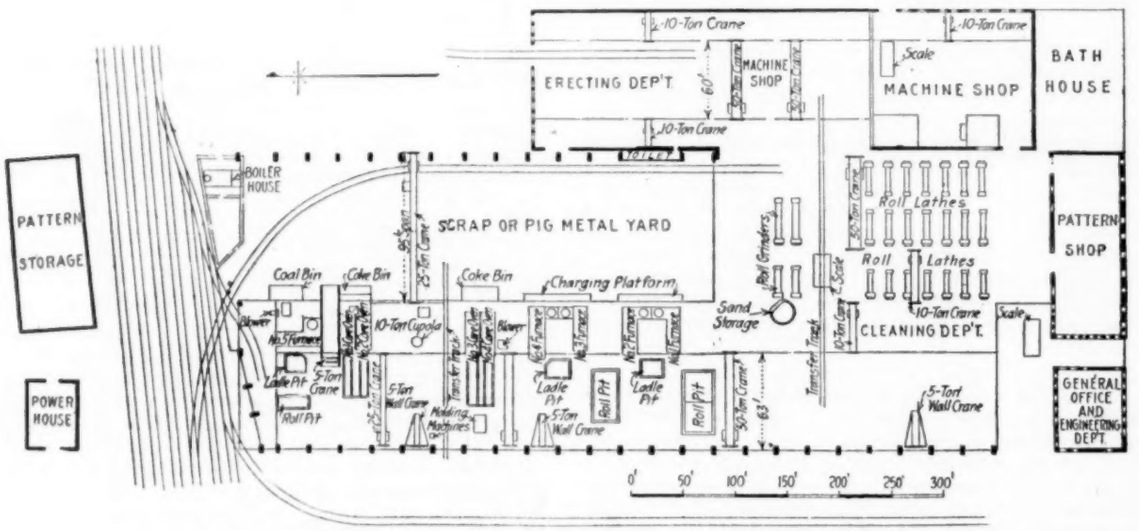
Improved Plant for Making Rolls for Metals

A Description of the New Foundry of the A. Garrison Foundry Company, Pittsburgh, Pa.*

The A. Garrison Foundry Company makes more rolls for mills running on copper and other non-ferrous metals than any of the other makers in the Pittsburgh district. Besides having helped to capture the home market for chilled rolls, for American manufacturers, it is an exporter on a fairly extensive scale both of rolls and mills. Recent shipments of the company were of two 44" Plate Rolls, each weighing 80,000 lbs. to Japan; a 34" x 100" Three High Plate Mill and a 42" Three High Universal Plate Mill to Italy.

By the completion of its new foundry, the company now possesses the facilities for taking care of demands for mills, exceeding in size any now installed and for rolls of larger diameter and wider face than are operating at present. The capacity of the equipment of the old foundry was taxed to the limit in the casting of one roll 42" in diameter with a face of 152". In the new plant, the company has arranged for a pit capacity of four rolls 44" in diameter, also for rolls having a rolling surface up to 210" long. Dozens of small rolls can be poured daily.

cupola, with normal capacity of 15,000 lbs. of metal per hour, but which if forced can produce 20,000 lbs. Two more air furnaces are to be installed later, these being indicated in the layout plan as Nos. 1 and 2. Furnaces already in are Nos. 3, 4, and 5. Nos. 1 and 2 are paired as are Nos. 3 and 4. No. 5 stands at the lower or river end of the building. Beside the feature of stoker-firing in which the company has been a pioneer and claims to have had good success, is the charging arrangement. As the furnaces back up to the storage yard, pig iron and scrap are charged direct from the stock piles and the labor and handling costs thus are reduced to a minimum. The furnaces, pits and the foundry proper are served by two overhead electric traveling cranes, one of 50 tons capacity and the other of 25 tons while for handling the flasks for the moulders there are three 5-ton wall cranes. Another 50-ton Main Bay crane is to be installed. The moulding floor covers an area of 25,000 square feet. An air operated Jarring Machine is used to mould medium sized flasks, while several small machines are used for small work. Compressed air is used



LAYOUT OF PLANT OF A. GARRISON FOUNDRY COMPANY, PITTSBURGH, PA.

As will be observed from the accompanying layout plan, the deep pits for casting long rolls are conveniently located in relation to the melting units and the pouring pits. These casting pits, which go below the level of the bed of the Monongahela river, are water tight. The larger of these pits is 26 feet deep and 30 feet long and 15 feet wide. The dimensions of the next smaller casting pit is 40 feet long by 18 feet wide. The upper end of the foundry floor is used as storage for chills and flasks. The leanto floor forms an alcove which affords storage space for refractories and other material which must be readily available and surmounts the furnaces, cupolas and core ovens, which thus are placed in off the main foundry floor. In the old foundry was a casting pit 15 feet in diameter and 24 feet deep, which is located in the leanto of the new plant. It was the first plan of the company to fill in this pit but later it was decided to use it for a bin or storage for sand. Being under cover, the sand can be kept dry and the hindrance of wet sand avoided.

The melting units already in operation consist of two 15-ton and one 25-ton coal burning stoker-fired air furnaces and a

for ramming the sand, and for chipping. In the cutting off of risers, the company has experimented with gas and electric torches, but without success, at least not for cutting the surplus metal from roll castings, which can only be removed by heavy roll lathes.

A mezzanine floor independent of the leanto floor and below it at the lower end of the building, contains the motors and blowers for the cupola and air furnaces. This floor and the main one above are steel plate over a concrete base. A 24 foot elevator at this end of the building with an opening to the stock yard, is the conveyance employed in lifting coke, pig iron and scrap for charging into the cupola. It also serves a core room and core ovens located on the main leanto floor. This floor is to be served by a monorail system running its entire length and to extend out to the storage yards where the company is to construct a coal pocket, etc. Coal is to be conveyed in grab buckets from this storage to the air furnace hoppers opening on this floor. Aside from the coal handling, the monorail system will serve a multitude of purposes, among them being the conveying of coke and metal to the cupolas, the delivery of sand to the large storage pit and the transferring of patterns to the projecting platforms that extend

*Abstracted from an article by G. F. Tegan in The Iron Age.

into the main foundry building. One of these three platforms is shown in photograph No. 2. The travelling cranes carry the patterns from these projecting platforms and place them on the moulding floor.

The company claims no unusual methods of foundry practice. Its machine shop contains no equipment uncommon to a plant of this kind except a 42" Milling Machine with four heads designed especially to mill bedplates for rolling mills. The machine shop is served by two overhead electric travelling cranes of 25-ton and 50-ton capacity, respectively. The entire plant is practically self contained for, in addition to the foundry and machine shop mentioned above, the following adjuncts are in use: an extensive laboratory, a large pattern shop, an immense roll turning and grinding shop, as well as consulting, engineering and designing departments. The thoroughly equipped departments have facilities for turning out mills and rolls from 8" in diameter Tin Foil Mills to 44" diameter Steel Plate Mills. At one time, could be seen on the erecting floor, separate mills for the rolling of aluminum, brass, copper, lead, steel and zinc.

NEW SHEET LEAD

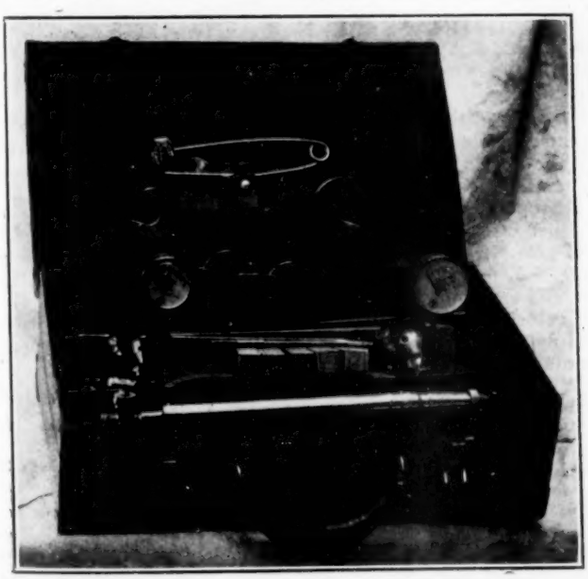
The Hoyt Metal Company, St. Louis, Mo., has just placed on the market Hoyt's Crawlproof Sheet Lead, designed especially for use in extremely hot acids as a resisting agent and also as a substitute for places where soft or hard lead will not now stand up. This is used only in the very hot temperatures and not in places where soft or hard lead can be used, say in temperatures below 220° F.

This material is said to be chemically pure sheet lead encasing hard antimonial lead bars, spaced at stated intervals, to act as reinforcing agents. When a slab of Crawlproof is rolled its original form is about 8' x 5' by 6" thick. The bars elongate as the sheet is rolled to any desired dimension, and sheets 8' wide can be furnished if necessary. It is claimed that it can be used to advantage in many places, especially where now vitreous ware or chemical brick is used. This material will burn perfectly.

The special feature is that the reinforcing bars act as steel hoops, and since they are not exposed are not eaten through as is the case when straight hard lead is used in these installations.

WELDING TORCH CARRYING CASE

The Davis-Bournonville Company, Jersey City, are putting out a carrying case outfit for welding, which includes the following: One Torch, style No. 7000; 3 extension tubes, style No. 7017, 5 in. long; style No. 7018, 10 in. long; style No. 7019, 15 in. long; Five welding tips, style 9, sizes assorted from No. 1 to No. 7. One decarbonizing tube, style No. 7020. One oxygen regulator, style No. 5500. One acetylene regulator, style No. 5501. Twelve ft. oxygen hose, with connections. Twelve ft. acetylene hose, with connections. One sparklighter. One pair colored glasses. One torch wrench. One regulator wrench. All securely and neatly packed for carrying in a fibre case with handle, metal hinges and fasteners.



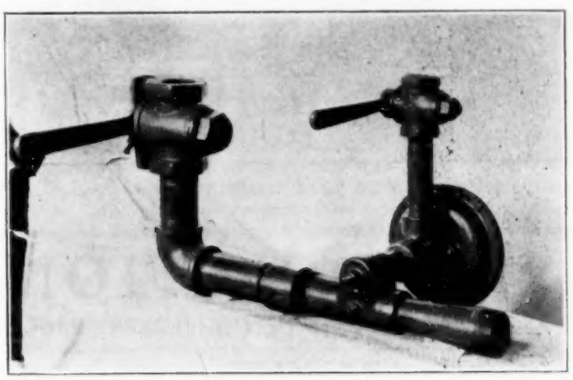
CARRYING CASE OUTFIT FOR WELDING

Attention is called to the fact that this outfit is sufficient for any welding job, regardless of size or conditions.

LOW PRESSURE AIR-GAS INSPIRATOR

The surface combustion low pressure air-gas inspirator, for many years used exclusively on The Surface Combustion Company's furnaces, has recently been redesigned so as to be readily applied to any make of gas furnace.

The manufacturers, The Surface Combustion Company, Inc., industrial furnace engineers and manufacturers, of 366-368 Gerard Ave., Bronx, New York City, claim that this inspirator is essentially a gas furnace carburetor. The entire operation of a furnace equipped with this inspirator is controlled through only one valve. An increase or decrease of the air supply automatically increases or decreases the gas so that the mixture proportions remain in a constant fixed ratio. The gas cock is used only when starting or stopping and is either full on or full off; no adjustment is required. No explosive mixtures are possible in any part of the distribution mains with this system, as the gas and air are mixed only at the point of supply to the burners.



SURFACE COMBUSTION FOR PRESSURE AIR-GAS INSPIRATOR

The advantages claimed are automatic supply of the exact proportions of air and gas to the furnace under all conditions of operation; thorough and homogeneous mixing of these fluids just prior to entering the furnace; and instantaneous combustion.

MONADIUM METAL

Monadium is an amalgamation of metals and metalloids, by means of a special process which, it is claimed, results in ductile, homogeneous, free-working alloys of high melting points. These alloys are produced both for casting and for working into sheet, wire, tubing, etc., in either bronze or silver color. It is stated that the metal takes a beautiful finish; and it has exceptional corrosion-resisting qualities.

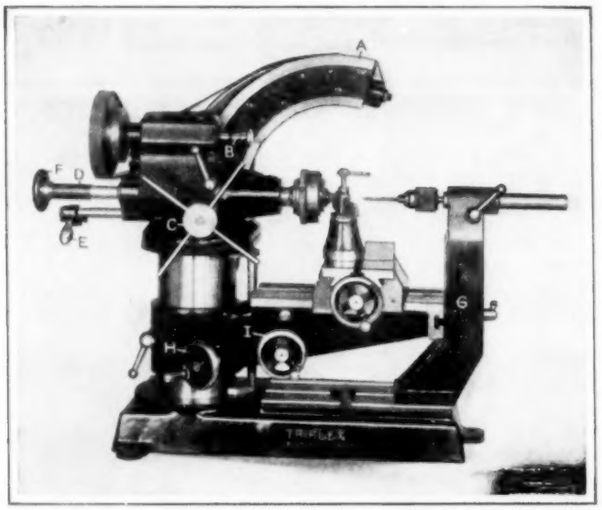
Monadium casting metal can be melted and cast into any desired shape or pattern. It can be machined, riveted, brazed, welded and soldered perfectly. They are said to be carefully standardized, which ensures your always obtaining the same mixtures, however, frequent or infrequent orders may be. It is not recommended for all purposes, but simply for fields. It is specially recommended for the following important products:

Automobile trimmings, soda fountains, creamery and dairy equipment, slicing machines, and other food handling machinery, tableware, kitchen utensils, plumbing goods, electrical appliances, surgical and dental instruments, hospital equipment, bank and office fixtures, motorboat trimmings,

and parts, marine hardware, various metal specialties, valves, bearings, pump parts, acid tanks, etc. Monadium is made by the Monadium Alloys Company, 110 S. Dearborn street, Chicago.

NEW COMBINATION MACHINE TOOL

The Triplex No. 1, made by the Triplex Machine Tool Corporation, 18 E. 41st street, New York, combination machine tool is said to do turning, milling and drilling. The machine is rigidly constructed throughout to withstand heavy duty. The universal features of the machine save time in making job set ups and in many cases eliminates the necessity of changing the positions of the work when performing a variety of operations.



TRIPLEX NO. 1 MACHINE TOOL

Turning between centers, with chucks, spring collets, taper turning and boring is done on the Triplex machine identically as it is done on any other bench lathe.

Internal and external thread cutting is accurately done by using a master screw of the required pitch, as illustrated. Drilling and reaming operations from the tailstock are also conveniently performed.

As a sensitive drill press, the spindle can be used for vertical, angular and horizontal operations. The spindle is driven directly by gears, creating a positive drive and eliminating belt slippage

NEW ENAMEL

Egyptian Crackle Enamel is made and marketed by the Egyptian Lacquer Manufacturing Company, New York. It can be applied over any of the standard Egyptian enamels and will produce, it is stated, a finish similar to alligator hide. It is also claimed that the size of the crystals can be regulated, making it possible to adjust this finish to any size or type of article. It is made in all colors, including black and white. It is said to have the same wearing qualities as other good lacquers or enamels, and to be unique and attractive in appearance, making it especially adaptable for art objects, interior decorating, lighting fixtures, etc.; also inexpensive to apply. Full information will be given to those interested by the manufacturers.

ASSOCIATIONS and SOCIETIES

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

AMERICAN ELECTROCHEMICAL SOCIETY

HEADQUARTERS, CARE C. G. FINK, 101 PARK AVE., NEW YORK

Preparations for the Baltimore meeting are progressing rapidly. Mr. William H. Boynton, Chairman of the Committee on Arrangements, and members of the Local Committee have been very active and all indications point toward a very interesting and attractive meeting. **Headquarters and Registration Bureau** will be at the Hotel Emerson, corner Calvert and Baltimore streets. **Members are strongly advised to make their Hotel Reservations early,** as the hotels will probably be crowded toward the latter part of April on account of the Racing Season. **The Technical Sessions** will be held on the mornings of April 27, 28, and 29, on the Mezzanine Floor of the Hotel Emerson. The **Social Functions** will take place in the afternoons of the meeting dates and will include: Golf tournament at the Baltimore Golf Club, visits to Industrial Plants and a specially planned boat trip, the steamer "Latrobe" having been chartered. On Thursday evening, April 27, Prof. W. R. Wood will deliver an illustrated lecture on "Fluorescence." This promises to be a highly fascinating lecture and should prove of interest to everyone in attendance. A **Complimentary Smoker** will be the main attraction on the evening of April 28. This smoker will be given by the chemists and engineers of Baltimore, at the Engineers' Club, which is but a short distance from the Emerson Hotel. On that occasion Prof. Roscoe R. Hyde, of the Department of Immunology, School of Hygiene and Public Health, Johns Hopkins University, will give a short talk on "Heredity."

Among the papers which have been accepted for publication are as follows:

"Electromagnetic Motions in Electric Furnaces," by Carl Hering, of Philadelphia.

"Idiomorphic and Hyp-idiomorphic Structures in Electrodeposited Metal," by W. E. Hughes, of London.

Other papers are pending the action of the Publication Committee and will be announced later in the program booklet which will shortly be distributed to the membership at large.

Electrodeposition Division: The result of the ballot vote for the adoption of the proposed By-Laws of the Electrodeposition Division, showing 115 in favor of the adoption and 1 opposed, was presented to the Board and accepted.

Electrothermic Division: The members of the Committee of this Division, recently appointed by the President, are as follows: Bradley Stoughton, Chairman, 1107 Broadway, New York City; Colin G. Fink, Secretary-Treasurer, 101 Park avenue, New York City; G. K. Elliott, Dorsey Lyon, J. A. Mathews, J. H. Parker, W. J. Priestley.

BRASS MANUFACTURERS

HEADQUARTERS, CARE W. M. WEBSTER, CITY HALL SQUARE BLDG., CHICAGO

At the meeting of the National Association of Brass Manufacturers held in Cleveland, March 7-9, 1922, H. N. Gillette, of the S. A. Cochran Brass Manufacturing Company, was appointed Chairman of the Standardization Committee.

A report on business conditions showed an increase of 118 per cent. for January of this year over the same month last year. February also showed a good gain over February, 1921. A quiet season, however, is expected to follow in March.

Factories are running an average of fifty hours a week, and most of the plants have made no wage reductions. Some plants are operating with a reduced force.

Wholesale prices have been reduced 10 per cent in the last month, it was announced.

The following announcement was sent out to the press:

EXCERPT FROM MINUTES OF CLEVELAND MEETING SYNOPSIS, MARCH 9, 1922

Members were warned to look out for German made goods or for representatives of German manufacturers now proselyting in the country, picking up samples and sending them back to Germany to see how cheap they can make them, also offering inducements to supply competitive articles of

German make at less than half the cost of American manufacture. It seems as though the Hun has done about enough to this country and its people in 1914 and a few years thereafter, that should not be forgotten.

WASTE MATERIAL DEALERS

HEADQUARTERS, TIMES SQUARE BLDG., NEW YORK

In the absence of H. L. Green, Chairman of the Metal Division, the meeting of that Division was called to order by President Overton on Tuesday afternoon, March 14th, at 3:45. Egmont Frankel, of Frankel Brothers, Toronto, Canada, was elected Chairman for the ensuing year, and the only matter of importance discussed was in connection with the Metal Classification. A letter was also read at this meeting from the Morton B. Smith Co., calling attention to what seemed to be excessive insurance rates, and this matter was referred to the Secretary for consideration and action.

METROPOLITAN BRASS FOUNDERS

HEADQUARTERS, CARE W. E. PAULSON, 97 SECOND AVE., BROOKLYN

The Metropolitan Brass Founders Association held its regular monthly meeting at 34 West 33d street, New York, on March 8, 1922. The speakers of the evening were G. D. Andrews of the Brown Instrument Company, Philadelphia, Pa., and Henry Hecht of the Alloys & Products Company, New York. Mr. Andrews spoke on Pyrometers, explaining their construction and use in the foundry. Mr. Hecht spoke on Alloys, and explained the use of deoxidizers and metal cleaners. It was a very interesting meeting, well attended, and the discussion showed that the speakers were appreciated.

NEWARK BRANCH, A. E. S.

HEADQUARTERS, CARE O. F. CARLSON, 225 West GRAND ST., RAHWAY, N. J.

The Annual Banquet of the Newark Brand will be held on April 22, 1922.

NEW YORK BRANCH, A. E. S.

HEADQUARTERS, CARE E. HAAS, 504 E. 163D ST., NEW YORK

The regular meetings of the New York Branch were held February 10th and February 24th at the Broadway Central Hotel. President J. A. Stremel presided. The meetings are well attended. The main topics under discussion were: Plating Sherardized Screws; Barrel Plating Die Cast Articles; the Best Basket to Use in Hot Acid Dip; Black Nickel Barrel Plating.

ROCHESTER BRANCH, A. E. S.

HEADQUARTERS, CARE E. E. FITCH, JR., 607 SAWYER ST., ROCHESTER, N. Y.

The Annual Banquet of the Newark Branch will be held on April 22, 1922.

NATIONAL VARNISH ASSOCIATION

HEADQUARTERS, CARE E. J. COLE, HILO VARNISH CORPORATION, BROOKLYN, N. Y.

The plant managers of the New York and Northern New Jersey Section of the National Varnish Association, held their 25th meeting, on Thursday, February 18. The subject discussed, "Driers and Drier Specifications," proved a most interesting one. Much of both theoretical and practical value was developed. Dr. Percy H. Walker of the Bureau of Standards, Washington, D. C., was present and contributed much of interest to the discussion. Annual election of officers was held. Frank M. Schumann, of Hilo Varnish Corporation, was elected chairman, and E. J. Cole, also of Hilo Varnish Corporation, was elected secretary.

PERSONALS

L. J. Buck has severed his connection with the National Carbon Company, a subsidiary of the Union Carbide and Carbon Corporation, and has become United States Sale Representative of the **British America Nickel Corporation, Ltd.**, Ottawa, Canada, with offices in the Canadian Pacific Building, 342 Madison avenue, New York. The British America Nickel Corporation is a Canadian corporation with Sir Robert Borden as chairman of its board of directors, and Hon. Edgar N. Rhodes, as president.

A. E. Ratner announces the removal of his offices from 128 Broadway to 50 Church street, New York.

William M. Corse took active charge of the work of the Division of Research Extension of the National Research Council in Washington on April 1, 1922. Mr. Corse is a prominent figure in the non-ferrous industry, having been connected in executive positions with Detroit Lubricator Company, the Lumen Bearing Company, the Titanium Bronze Company, the Ohio Brass Company, and the Monel Metal Products Company. He has for many years been an officer of the Institute of Metals Division of the A. I. M. E.

James L. Ashley has been elected vice-president of the International Nickel Company.

Charles F. Brooker, Chairman of the Board of the American Brass Company celebrated his seventy-fifth birthday on March 4, 1922. Congratulations poured in on him from all parts of the country.

DEATHS

JAMES A. DOUGHTY

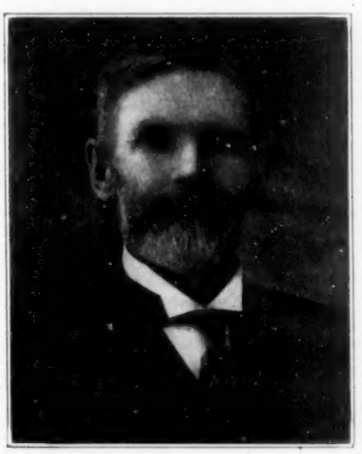
James A. Doughty, president of the Torrington Manufacturing Company and for many years actively identified with the Coe Brass Manufacturing Company, died suddenly March 16 at his home on Wilson avenue, Torrington. Death was due to heart failure. Mr. Doughty was one of the best known and most beloved citizens of Torrington and was widely known in metal industry circles throughout New England.

He was born in Beekman, Dutchess County, N. Y., and was a descendant of Rev. Francis Doughty, who came from England in 1634, and who was the first English preacher in New Amsterdam, now New York City.

Mr. Doughty came to Torrington in 1882 as a salesman for the Coe Brass Company. A short time later he was appointed assistant to Charles F. Brooker, then secretary of the company. When Mr. Brooker was elected president in 1894, Mr. Doughty was elected secretary. In 1908 he was advanced to the office of vice-president. He was a director of the American Brass Company from the time of its organization until last January.

Mr. Doughty's business connections were most varied outside the organization of the American Brass Company. He was, as stated above, president of the Torrington Manufacturing Company, president of the Thomaston National Bank, secretary and treasurer of the Torrington Printing Company and a director in many other corporations.

He was president of the Torrington Club, a trustee of Seneca Lodge, F. & A. M., an incorporator of the Torrington Homes corporation, which was or-



JAMES A. DOUGHTY

ganized in 1919 to relieve the housing situation in Torrington, and a big contributor to the Gaylord farm sanatorium at Wallingford and the Torrington Y. M. C. A. Only recently he gave a splendid building to the Gaylord farm sanatorium and equipped it at his own expense.

Mr. Doughty was married on February 7, 1878, to Miss Alice J. Brooker, a sister of the late Major A. F. Brooker. The wife and one daughter, Marion, are the surviving relatives.

The funeral was held Sunday, March 19, 1922, from the Center Congregational church, Torrington. The honorary pallbearers were Charles F. Brooker of Ansonia, John A. Coe, E. L. Frisbie and John P. Elton, of Waterbury; Russell A. Cowles, G. W. Burnham, Uri T. Hungerford, and Robert Debacker, of New York; W. A. Cowles of Ansonia, and Edward H. Hotchkiss, Robert C. Swayze, Luther G. Turner, John N. Brooks and Thomas W. Bryant, of Torrington. The active bearers were Frederick L. Braman, Arthur L. Brewer, Lyman B. Comstock, John Gath, Henry G. Ellis, George W. Peterson, John G. Tuttle and J. B. Thursfield. Interment was in Hillside cemetery.

THOMAS H. A. EASTICK

Thomas H. A. Eastick died in Montreal, Canada, March 7, 1922, as a result of a fracture of the skull received from being struck by a piece of ice falling from the roof of a house as he was walking by. He was buried in Danville, Ky.

Thomas H. A. Eastick was born in London, England, on January 21, 1893, and was educated at the London Polytechnic Institute. He came to the United States in 1909 and took a position with the Bridgeport Brass and Foundry Company at Bridgeport, Conn. He was with the Bridgeport Brass for six years doing metallurgical and research work and then joined the Winchester Repeating Arms Company, with whom he worked for about two years. He was then employed by the duPont Powder Company in the development of tracer bullets, which lasted for about a year, and following this was engaged in consulting work for about a year. He came to the Canadian Explosives Limited in the fall of 1919 and was engaged in metallurgical work for the Copper Products Plant and the Dominion Cartridge Company of that organization.

THOMAS H. A. EASTICK.

Mr. Eastick was a prominent figure in the metal industries. He had an excellent reputation as a foundry expert and metallurgist; he was the author of papers read before technical societies and a number of articles published by THE METAL INDUSTRY.

Some of his more important articles were the following: Cupro-Nickel; Structural Characteristics of Rolled Sheet Brass; Corrosion of Copper; Melting Furnaces. He also participated in the discussion held in THE METAL INDUSTRY on Electric vs. Crucible Furnaces.

At the time of his death he was Metallurgist for Canadian Explosives, Ltd., Montreal, Canada. He was a member of the Institute of Metals Division, A. I. M. E.

TRADE CORRESPONDENCE

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS

WATERBURY, CONN.

APRIL 1, 1922.

The development of the manufacture of copper shingles by the **American Brass Company** is expected to result in improved business activity in the brass trade. Since the absorption of the Brass company by the Anaconda Mining Company, the shingles, which had previously been rolled in the Perth Amboy plant of the latter company, have also been rolled in the Brass company's mills here and in Ansonia.

The **Waterbury Clock Company** subject to the approval of the bankruptcy court will purchase the assets of **Robert H. Ingersoll and Brother,** for $1,500,000, the purchase including the local plant, the plant in Trenton and the capital stock of the Ingersoll Watch company of London. Under the terms the Clock company agrees to waive all its claims against the bankrupt company and also to pay additional cash consideration to clear up past transactions, bringing the total purchase price to over $1,750,000. This offer was made following the order of the court to sell the assets at auction unless an offer of $1,500,000 was received. Creditors of the Ingersoll company have protested against the sale, on the ground that the assets of the company are worth $3,300,000, and have secured a postponement of the sale which was scheduled for March 20 until March 29th. They claim that besides the value of the assets as given above, there is $1,000,000 worth of finished watches on hand and that the good will of the company has not been figured in the transaction. Settlement on the basis of the offer made would give the creditors 60 cents on the dollar.

The **Lux Clock Company,** due to increased business is shortly to build a brick addition to their factory, costing about $10,000. It is one of the few factories in the city which has shown an increase in business in the past year, its products being clocks for time smiths, taximeters, recording instruments, bank and novelty clocks. This is the third addition it has made to its present large factory on Sperry street.

Rumors have been current in the city for a month that **Henry Ford** had been attempting to purchase a factory site in various sections, such as the American Brass company's land on the Naugatuck river, land owned by the Chase interests and land owned by the Scovill company in the east end. The rumors became so strong that the local chamber wrote the Ford company in regard to it, and received an absolute denial from Frank Campsall, Ford's secretary, of any knowledge of intent of the company to locate in Waterbury.

John H. Goss, vice-president of the **Scovill Manufacturing** is a member of the **State Industrial Wastes Board,** which has recently reported on pollution of the Naugatuck river, into which most of the brass factories here and throughout the valley empty their sewage, after a two year investigation. The general method finally recommended for purification is sewage disposal plants, excluding such industrial wastes as would interfere with the use of the sewers of operation of the disposal plant. The most economical and satisfactory method for disposing of industrial wastes would probably be treatment near their sources in the factories.

Waterbury ranks 25th in the number of cities reporting employment increase since February, according to announcement of the department of labor, the increase being 2.3 per cent.—W. R. B.

BRIDGEPORT, CONN.

APRIL 1, 1922.

Bridgeport made its first bid for fame as an ideal industrial city this month when the Boost Business committee inserted in prominent daily newspapers in all large cities of the country a series of advertisements extolling the locational advantages for budding industries here. Not only the daily press of New York, Chicago, Detroit, San Francisco, New Orleans and Boston are used as a medium but a circularizing of the same territory has been provided. Each inquiry will be answered by the committee, and followed up by sending a "city salesman" to visit the inquirers.

The **Manufacturers' Association** states that reports from 31 local factories shows that prosperity is slowly returning to the city, and industrial activity is steadily on the increase. For the week ending March 4th, the number employed was 13,659, or 53.9 per cent of the normal personnel of these plants. This was the best showing made since late last November and early December. The improvement in industrial conditions is also reflected in certain increases in the number of working hours weekly, effective recently. For the week ending March 18th, still greater improvement was shown, the number employed being 14,059, an increase of 400 over two weeks before, an increase of 55.5 per cent of normal, and the best showing since June of last year. The total of man hours for the 14,059 employees was 610,464. This is the best showing since May. The average number of hours per week in the 31 factories was 45.5 or 92.9 per cent of normal, the best showing since war time activities. It is understood that the increase in employment and in hours in factories not included in the list of 31, is in keeping with them.

The balance sheet of the **Columbia Graphophone Company** for 1921 shows a deficit after dividends were declared, of $15,881,668, compared with a surplus for 1920 of $1,497,923. This was due largely to the inventory adjustment of $11,031.64.

The **Remington Typewriter Company** here is now working full time with a prospect of increasing demands in the near future, according to the officials.

At the recent annual meeting of the **Bridgeport Rolling Mills** it was announced that the plant was now operating 55 hours a week to about 90 per cent capacity.

The new addition to the plant of the **Union Specialty Company,** work on which has been started, will be 120 by 50 feet and of thorough fireproof construction.

The **Submarine Boat Corporation's** report for 1921 showed a net loss of $6,611,997, compared with a net income in 1920 of $1,865,095. After crediting $4,412,521 for adjustment of reserves the net loss amounted to $2,199,476.

The **Manufacturers' Association** has recommended to its members that they adopt daylight saving time beginning April 30 by turning their clocks ahead one hour, and maintaining it until September 24. This action is necessary if the shops are to operate on daylight saving time this year as a state law forbids municipalities from turning their clocks ahead or advising such change.

John A. Hurley, a retired manufacturer, well known throughout the state died March 14th at the age of 68. —W. R. B.

TORRINGTON, CONN.

April 1, 1922.

The old casting shop buildings at the Torrington branch of the American Brass Company are being torn down to make way for a new and more up-to-date building to be erected shortly. The new building will be one-story high and will be used for rolling mill purposes. Construction work, it is expected, will be started in the spring. The old casting shop buildings were no longer needed after the new casting shop was completed a few years ago.

The spring freshet which caused the Naugatuck river to attain a new high water mark recently, carried away one of the brick walls of the pattern storage building at the Torrington Manufacturing Company's plant.—J. H. T.

ROCHESTER, N. Y.

April 1, 1922.

According to those who are in a position to know best, there has been a substantial improvement in most of Rochester's metal-using industries since the beginning of the month. In other words, the advent of Spring apparently has brought with it better cheer and a promise of increased business. In some of the larger plants about the city the increased activity is quite noticeable, and it is a fact that the aggregate of unemployed among the skilled class of workmen is gradually growing less.

Salesmen returning from long trips and representatives of the larger concerns in various parts of the country report that orders are beginning to come in with greater ease and in increasing volume. Of course this slow incline upward has been noted since the first of the new year, but the month of March has witnessed a well-defined movement toward more normal conditions.

Much of this demand has been brought about by the sudden resumption of building activity in Rochester, which fact has been of marked value to the electro-plating establishments in the city.

Although business is improving in large plants there is not the rapid betterment that was hoped for. It is said that the delay in tariff adjustment is hindering the return to normalcy of not only big institutions but a score of other plants in Rochester. It is not a secret that German competition in certain lines is placing a number of Rochester industries at a disadvantage in their own territory.

AMERICAN FOUNDRYMEN'S CONVENTION

In June Rochester will entertain the convention of the American Foundrymen's Association. It is predicted that the registration of delegates and their families will exceed the five-thousand mark.

Norman Van Voorhis, president of the Galusha Stove Company, has been chosen as chairman of the executive committee appointed by the local foundrymen to arrange for the convention. Porter B. Van Deusen, of the Chamber of Commerce, will serve as secretary. The convention itself will be arranged by C. E. Hoyt, secretary of the American Foundrymen's Association, with headquarters at Chicago. Mr. Hoyt made several visits to Rochester before finally accepting the invitation of the city and the Chamber of Commerce to bring the convention here.

The members of the executive committee, who will serve with Charman Van Voorhis, are as follows: Schuyler H. Earl, of the Gleason Works; Matthew Elliott, of Erie Foundry Company; H. G. Hetzler, of North West Foundries, Inc.; A. H. Jones, American Woodworking Machinery Company; George B. Pettingill, of the T. H. Symington Company; T. A. Soults, of the Sill Stove Works, and Louis P. Willsea, of the Willsea Works.

Several sub-committees have been named as follows:

Entertainment Committee—H. G. Hetzler, chairman; David Baxter, A. N. Brayer, E. A. Scheibe, Delos H. Wray. Representing American Foundrymen's Association, C. E. Hoyt, secretary, Chicago; W. B. Robinson, Pittsburgh; W. W. Sanderson, Niagara Falls; William J. Wark, Buffalo.

Banquet Committee—Past President A. E. Howell, Nashville; Past President J. P. Pero, Montreal; W. R. Bean, Naugatuck, Conn., president; George B. Pettingill, Louis P. Willsea.

Golf Committee—Matthew Elliott, chairman; Donald S. Barrows, William S. Riley, J. F. Weller.

Hotel Committee—A. H. Jones, chairman; A. R. McHenry, A. J. Messner.

Publicity Committee—Edgar F. Edwards, chairman; George Ely, H. G. Stellwagen.

Reception and Information Committee—Louis P. Willsea, chairman; Arthur Batzold, Matthew Elliott, L. W. Fulreader, James E. Gleason, C. W. Griswold, Frantz Haverstick, David R. Henry, Charles P. Hery, Arthur H. Ingle, A. C. Kehr, V. C. Kreuter, James McHenry, S. E. Miller, S. W. Miller, Charles S. Owen, Theodore Pickering, Robert L. Poole, T. A. Soults, Mayor C. D. Van Zandt.

Finance Committee—Schuyler H. Earl, chairman; Matthew Elliott, Norman Van Voorhis.—G. B. E.

TRENTON, N. J.

April 1, 1922.

The metal industry in Trenton is holding its own and the manufacturers believe that the coming season will be a good one. The majority of the plants are being operated on full time again and this is an indication that business will continue good. The **Trenton Emblem Company**, of 120 Hamilton avenue, Trenton, has found that business has increased to such an extent during the past few months that a large addition will have to be added to the plant. The firm has contracted for a one-story addition, 36 feet in width and 77 feet in depth, of brick and steel and this will be used as

a foundry. Frederick A. Barton, president of the company, says he looks for a boom in the industry and that he has plenty of orders on hand. The big plant of the **John A. Roebling's Sons Company** is also feeling a revival in business. General Superintendent William A. Anderson says that the factory is running about 60 per cent capacity.

It is rumored that the **W. W. Morgan Company,** of Reading, Pa., will establish a nickel and brass factory at Alloway, N. J. The chamber of commerce of that place visited the Reading plant and offered good inducements. A wealthy resident of Alloway offered to donate a parcel of land and also to erect the buildings. The firm manufactures plumbing fixtures and bathroom supplies.

With the purchase of the plant of the **Ingersoll-Trenton Watch** by the **Waterbury Clock Company** it is now expected that the Trenton factory will shortly see a revival in business. The deal involved an expenditure of $1,500,000 in cash and the waiver of claims against the watch company. The sale also included the plant at Waterbury, Conn. There are now about 100 hands employed at the Trenton factory. When the plant was running full time 550 experienced hands were employed. All these employes are residents of Trenton and are available for employment as soon as enough orders have been received to start the various departments in operation.

Robert K. Bowman, vice president of the **Jordan L. Mott Company,** says that a revival in business is indicated in the fact that the books of the company show orders to be 40 to 50 per cent heavier than they were a year ago.

Donald L. Parker, of the **Trenton Welding Company,** recently gave a talk to the Trenton Rotary on "Oxy-Acetylene Welding," in which he showed economy and durability of the modern process of welding compared with the old-fashioned forge method. He reviewed the welding methods and stated that during the past 15 years many processes of joining metal parts have been developed which have taken the place of ordinary forge welding. Mr. Parker said that oxy-acetylene welding was very economical and that it saved time for the plant owner and was very durable. He said that in a very short time welding by gasses has reached a point where it may be depended upon to remedy most of the metal difficulties promptly and efficiently.

Universal Tool Company, of Garwood, N. J., has been incorporated at Trenton, N. J., with $125,000 capital to make hardware and auto accessories.

The **Trenton Hardware Company,** 35 East State street, Trenton, has been incorporated with $250,000 capital stock.

The **Economy Sales Company,** Toms River, N. J., has been incorporated at Trenton with $125,000 capital to engage in the wholesale and retail hardware business.

Mechling Brothers Chemical Company, Camden, N. J., has been incorporated at Trenton with $1,000,000 capital to manufacture chemicals, etc.—C. A. L.

DETROIT, MICH.

APRIL 1, 1922.

Business locally in the brass, copper and aluminum field has been better within the last month than at any time during last year. It has been pronounced even better the last three weeks than for the same period a year ago. Strange as it may seem, a few plants are reported engaged in night work. Two conditions have brought this about. Increased demand for automobile parts and the wireless craze that has hit this section. Just what the latter is going to amount to no one can forecast, but it certainly has done wonders in stimulating manufacturing here. The demand for brass parts and copper wire has come with a rush.

Added to this the automobile industry is swinging along well, and the demand for automobile parts has added to the general upward business trend.

Henry Ford has just announced his intention of taking on from five to ten thousand more men in his tractor plant. Like the automobile, this machine requires brass and aluminum parts. All of this is good news to business, not only in Detroit, but to the outside sections as well. The demand for skilled workmen here is much better than a year ago. But there is an overplus of unskilled workmen and unless a man is trained mechanically it is well for him to stay away from Detroit.

Just at present the business outlook is the best it has been for the last twenty months. How long it is going to last no one can say. Nevertheless, it looks as if conditions in general were breaking for the better, with prospects for a summer much ahead of that of a year ago.

The coal strike will not affect Detroit industrially for a long time if it does at all manufacturers, anticipating the situation, have laid in ample supplies of coal. The **Ford Motor Company** owns its own mines, operated by non-union miners. It also owns a five hundred mile stretch of railroad from Detroit direct to its mines, so its 40,000 or more employees have no fear they will be forced out of work if the strike lasts a year.

Outside the automobile and electrical demand there still is not much doing. The demand for plumbers' supplies is only moderate. The same is true of builders' hardware.—F. J. H.

LOUISVILLE, KY.

APRIL 1, 1922.

General conditions have not shown much change during the past month or two, there being a little better general industrial demand for brass and copper castings, and sheet metal, tubes, etc., but as a whole the coppersmiths are not busy. However, castings are in better demand as industrial concerns have allowed stocks to run low, and are finding a better demand for their products.

The plumbing trade is very active at the present time, the great **Ahrens & Ott** division of the **Standard Sanitary Manufacturing Company,** at Louisville, operating full in some departments at this time, and reporting especially heavy shipments to the Pacific coast, where building is very active.

A great deal of bank office improvement is being reported from the state, and there has been some of this work locally, which has resulted in some demand for bronze work, grills, etc.

A big merger deal is pending in Louisville whereby the **Kentucky Wagon Manufacturing Company,** and about fifteen other automobile concerns are planning to enter into a big combine to be known as the **Associated Motors Company,** which if it becomes effective, will mean practically full time operation for the big plant here.

The **C. Lee Cook Manufacturing Company,** Louisville, manufacturers of metallic packing, have recently taken permits for erection of a large foundry addition to the plant.

Business with the **Independent Brass Works** is reported as very fair, the company having had quite a nice volume of general casting business for some weeks past.

The **Stege Brass & Plating Company** reports very fair business, having received a good deal of work from automobile owners and garages for nickel-plating, and a good deal of headlight work for autos.

The **Vendome Copper & Brass Works** is operating part time, the volume of business coming in being small as a whole, and the general situation being discouraging.—A. W. W.

CLEVELAND, OHIO

APRIL 1, 1922.

Conditions in the Cleveland district continue to show the same steady rate of improvement noted last month. Practically every industry, with the possible exception of building which is in the midst of a strike, has shown decided improvement, and plants are hiring more men daily.

Prominent among the industries which have shown a radical gain are the automobile plants. During the past few months Jordan, Chandler, Templar, Stearns, White, and a dozen others have radically increased their forces. In addition the Zeder Motor Company, headed by Fred Zeder, until recently chief engineer of the Willys Corporation, has been organized and will begin production at the plant of the Cleveland Tractor Company.

The **Cleveland Brass and Copper Mills** which have been closed for the past few months, will probably be the center of some interesting developments shortly. As yet, says B. A.

Branske of the firm, plans are too premature to be announced. However, it may be stated that rumors to the effect that the company will go out of business are unfounded, although reorganization is regarded as possible.

The recent convention of the National Association of Brass Manufacturers at the Hotel Cleveland attracted much local interest through the efforts being made by that body to standardize brass production and eliminate obsolete products. Officers attending included L. D. Lawning, St. Louis; J. B. Brazier, Charleston, W. Va.; L. Opke, Pittsburgh, Pa.; R. H. Smith, Springfield, Mass.; F. J. Forbes, Baltimore, Md., W. M. Webster, Chicago.

James O'Connell, president of the metal trades department of the American Federation of Labor will address a mass meeting of Cleveland metal trades workers on April 7. The mass meeting is being held in connection with the reorganization of the various metal trades workers' unions in this district.

William Spence, Senior, of Springfield, Ill., has filed suit against the **Akron Spark Plug Company** for $22,000, which he claims to have loaned to the company. Charles L. Hoffmeyer, of Akron, Ohio, was recently appointed receiver for the concern.—C. C. C.

INDIANAPOLIS, IND.

April 1, 1922.

Among the Indianapolis manufacturing concerns that are making progress toward recovery is the **Acme Works, Inc.,** makers of aluminum, brass and bronze castings and wood and metal patterns. Peter Lambertus, president of the concern, said that he expected his firm to be working at full capacity before the end of the year, with a full force of mechanics, pattern makers and other laborers.

Breach of contract is charged in a suit for $42,000 filed in the federal court by the **Hope Webbing Company,** of Providence, R. I., against the **Zenite Metal Company,** of Indianapolis. The plaintiff avers that the Indianapolis concern refused to accept 61,151 pounds of webbing ordered in the spring of 1920 to be bought at $1.35 a pound.

Articles of incorporation were recently filed with the secretary of state by Harley D. Hartley, Holly B. Harvey and Roy H. Hartley showing a capital stock of $50,000 in the newly organized **Indiana Foundry Corporation** of Muncie, Ind. The new corporation will do a general foundry business.

The **Eagle Foundry Company** has been organized recently at Muncie, Ind., with a capital stock of $25,000 for the purpose of doing a general foundry business. Harley D. Hartley, Holly B. Harvey, and Roy H. Hartley are directors of the company.

Riley C. Adams of Indianapolis, receiver for the **American Metal Corporation,** has notified all creditors of the concern that all accounts, grades and demands shall be verified and filed with him on or before April 15.—E. B.

MONTREAL, CANADA

April 1, 1922.

Business continues to improve as the season advances but not any more than was reasonably expected. This is especially true in the non-ferrous industries for although the month of February was better than January the figures now totalled show merely the seasonal increase. The outlook for the coming month indicates a greater improvement in sales. As a result of the higher prices for farm products and the feeling that there will be a good demand at those advanced prices for this year's crops there is a marked change in sentiment among business men.

Canadian holders of **International Nickel Corporation** shares manifest special satisfaction with the selection of **John L. Agnew** as President of the **Canadian International.** Mr. Robert S. Stanley has become president of the **International** and **New Jersey.**

Accompanying the announcement that Messrs. Stanley & Agnew are the new presidents of the respective New Jersey and Canadian organizations is the further information that **Charles Hayden** of Hayden, Stone & Co., who is among the greatest producers and market-masters, has been elected chairman of the International of New Jersey Board; Treasurer **J. L. Ashley** and **Fred S. Jordan** are now vice presidents. **Briton Osler** of Toronto, who is general counselor, is another new director. **William Wallace Mein** is consulting engineer.

The **Magnolia Metal Company** have completed their new factory on Shannon street and are now fully equipped for refining and smelting white metal alloys. The equipment includes new reverbatory furnaces and facilities for chemical research.—P. W. B.

BIRMINGHAM, ENGLAND

March 15, 1922.

In most of the metal trades the hopes entertained at the beginning of the year still await realization. Business in tubes is exceedingly slack and one of the largest works in the Midlands is practically shut down. The sheet mills are doing very little better. Bedstead manufacturers have gained very little new business by their recent cuts in prices. A trifling increase in orders followed the issue of the new lists. This was succeeded by a relapse into the former dulness, but during the last few days a little movement in export business has taken place. Reductions have been conceded to the bedstead trade by manufacturers of square bar tube and wire mesh. In brass materials no general concession has been obtained. In brass foundry the only firms having a fair amount of employment are those producing steam fittings and plumbers' brass foundry. Price-cutting is on the increase and very few firms are working at a profit. The cabinet brass foundry trade is in a most despondent state. Very little is being done and any renewal of demand for door and window furniture and other domestic fittings will easily be met from stocks which have been long accumulating. Although export business in the metal trades shows no marked increase in its total volume, there have been recently some encouraging features. From the South African market, after a long spell of dulness, enquiries for general brass foundry are slightly on the increase. The capture by the **Vickers-Metropolitan Company** of a big railway electrification contract in that Dominion, to a value approaching £1,000,000 will provide work for many months. The electrical material will be made at the company's Manchester works and the rolling stock in the Birmingham district. The Birmingham brass trade is hoping to derive some benefit from the business in the way of subcontracts. The electrical trades are also hoping to benefit by contracts arising out of the grouping schemes which home railways are undertaking at the instance of the Government. The General Electric Company has already obtained a large contract for the electrification of the Brighton railway. This will provide occupation at the company's Birmingham works for twelve months.

Business with India continues to improve. Small orders are being received in various departments including brass sheets for the native workers. South America is taking a little more general brass foundry. Orders from this and other overseas markets are usually small and urgent, betokening lowness of stocks, and in many cases are accompanied by remittances. Australia and New Zealand are still the steadiest customers to the home metal trades. Importing firms in these dominions show anxiety to increase their purchases, but find a difficulty in getting the necessary credit from their bankers.

An example of the position most manufacturers found themselves in at the end of last year is afforded by the report of the **Delta Metal Company,** of Birmingham. The year's trading showed a net loss of £3,084, and though a dividend of 10 per cent was paid it came out of reserve funds. Some other metal and tube firms, for instance, Charles Clifford & Sons, show a small profit for the year, but dividends are made up out of the earnings of former years.

So long as the shipbuilding and engineering and allied industries continue to suffer from the present unexampled depression very little hope can be felt of any improvement in the position of such firms. Significant of the depressed feeling amongst Midland manufacturers is the fact that at the Birmingham Section of the British Industries Fair which will open on February 27th the number of exhibitors will be little more than half of last year's total.—G.

VERIFIED NEWS

The **General Platers' Supply Company, Inc.,** has been legally dissolved, pursuant to the provisions of the law of the state of New York.

The **Canadian Aluminum and Brass Company, Ltd.,** Walkerville, Ont., was recently incorporated with a capital stock of $250,000, by John P. Carritte, Hiram H. Walker and E. M. McLean. They manufacture castings.

The **Aluminum Die Casting Corporation,** of New Jersey, will manufacture die castings and will take over the business of the Acme Die Casting Company, Brooklyn, N. Y. The plant will be located in Garwood, N. J.

The **Bridgeport Brass Company,** Bridgeport, Conn., has appointed W. D. Blatz general sales manager. He joined the marketing organization of the Bridgeport Brass Company in 1915.

The **Eugene F. Phillips Electrical Works, Ltd.,** Montreal, Canada, are at present erecting a copper rod rolling mill at Brockville, Ont., and it is their intention to eventually move the whole of their works to this site. The new plant is estimated to cost between two and three million dollars.

The **Barium Products Corporation,** Carbondale, Ill., has been incorporated with a capital of $40,000 to manufacture barium compounds and sodium sulphide. They have taken over the plant of the Peroxide Chemical Company at Carbondale.

As a direct result of the world-wide experiments in rehabilitation of men injured in war, America has now a hospital dedicated solely to the care of industrial diseases and accidents and the restoration of industrial casualties to active useful life again. The **Reconstruction Hospital,** with the breaking of ground Sunday, April 2, for its new eleven-story addition at 100th street and Central Park West, New York City, now enters upon a national career, prepared to offer a unique service to industry. The total cost of the new annex will be $1,500,000.

The **Standard Metal Company,** Indianapolis, Ind., has increased its capital from $100,000 to $250,000.

The **Leonard E. Lynd Manufacturing Company,** Mechanicville, N. Y., suffered the loss of their entire plant by fire. They are now starting to reconstruct it, and will be in the market for supplies about July 1. They have been operating a nickel-plating plant, and a tool and grinding room.

T. E. Conklin and Company, of 61 Duane street, New York, will change its name on May 1, 1922, to T. E. Conklin Brass and Copper Company, and move to larger quarters at 54-60 Lafayette street, New York. They carry a large stock of copper and brass in all shapes.

Kneller, Vaughn and Company, Inc., New Haven, Conn., has been incorporated with a capital of $50,000, by Charles S. Vaughn, Henry S. Kneller and Frank H. Kasperson, 332 Norton street, New Haven. They specialize in the manufacture of "Skoot" distilled metal cleaner, said to be a non-inflammable, non-injurious and odorless preparation for removing paint, varnish, grease, and all such other foreign substances from metal, without the necessity of burning, scraping or sandpapering. Their plant is located at 17 Farren avenue, New Haven, Conn.

Oscar Powers announces to the trade that he has severed all connections with the firm of Sali, Kahn and Powers, and hereafter will be located at 296 Broadway, New York, where he will continue doing business, dealing in brass and copper sheets, rods and tubing.

The annual meeting of the stockholders of the **Bridgeport Rolling Mills, Inc.,** was held at the office of the company, corner Bruce and Stratford avenues, Bridgeport, Conn., March 13th, 1922, at two o'clock P. M., at which time the following directors were elected: William R. Bull, Anker S. Lyhne, George D. Stearns, Anton C. Raffauf. The directors thereupon elected the following officers for the ensuing year: President, William R. Bull; vice-president and general manager, George D. Stearns; secretary and treasurer, Anton C. Raffauf. The management reported that the mill was now operating fifty-five hours each week at about 90% capacity.

The **Peerless Metal Products Company,** 3020 North Illinois street, Indianapolis, Ind., manufacturer of metal articles, has leased space at 109 West 10th street, and expects to be in operation there shortly. The company operates a casting shop, and stamping, plating, polishing, japanning and lacquering departments. A. E. Shirley, of Shirley Brothers, Indianapolis, is president; J. A. Spahn, vice-president, and Joseph P. Hanley, secretary-treasurer.

The plant of the **American Foundry Equipment Company** at York, Pa., is getting ready for bigger business by moving from the old location on North street to larger and better adapted quarters on East Market street, adjacent to the Maryland and Pennsylvania Railroad. The company's molding machines, flasks, jackets, and pattern mounting sundries are manufactured at this plant. Sand cutting machines, sand blast equipment, dust arresters, and core machines, will continue to be manufactured at the main plant, 2935 West 47th street, Chicago.

The **Seattle Brass Company,** Seattle, Wash., has been incorporated with a capital stock of $100,000, by William Edris and L. B. Stedman. They operate a brass bronze foundry, brass machine shop, tool room, grinding room, and plating and polishing departments.

Hauck Manufacturing Company, 126 Tenth street, Brooklyn, N. Y., which manufactures portable oil burners, torches, furnaces, etc., has moved its Philadelphia office to 1726 Sansom street (Bell telephone, Spruce 5626). J. A. Armstrong, who has been connected with the company for three years will be in charge of the office. This company operates a brass machine shop, tool room, and tinning, brazing and soldering departments.

The **Mutual Equipment Company,** 251 Fort Washington avenue, New York, has been organized by S. H. Baird, D. E. Hadley and J. F. Kevern, to manufacture sand blast equipment of all types, cloth screen dust collectors and air purifiers, tumbling and water polishing mills.

The assets of **Robert H. Ingersoll and Brother,** bankrupt, have been purchased by the **Waterbury Clock Company,** for the sum of $1,500,000.

The **William Dixon Company, Inc.,** of Newark, N. J., have been in their new building at 32 East Kinney street, since 1921. They also maintain a New York sales room at 119 Fulton street. The business is the result of a consolidation between the late William Dixon's original business and that of F. W. Gesswein in 1896, which has continued to date without a change (except in name) to the present time.

The **Amalgamated Metals Selling Company,** Limited, 42 Broadway, New York, has been appointed sole U. S. Representative of the Erftwerke A. G., Grevenbroich, Cologne, Germany. This concern is said to be the largest and most important producer of virgin aluminum in Germany.

INTERNATIONAL NICKEL COMPANY

Robert C. Stanley, formerly first vice-president, was recently elected President of the International Nickel Company. Mr. Stanley has ordered a reorganization of personnel, involving as its chief feature a new department of Development and Research, with headquarters at 67 Wall Street, New York City.

The new department of the company is the outgrowth of a gradually maturing conviction that a study of its products and their successful use in the hands of the consumer is the key to the extension of tonnage distribution. Research departments at the mines, smelters and refineries of the company, established during the last few years, have now been crystalized into a headquarters organization in intimate touch both with its own plant development and with outside engineering developments, touching on the use of Nickel and Monel Metal in all fields. This department will be under the direction of Mr. A. J. Wadhams, as manager. Associated with him will be Dr. Paul D. Merica, director of research.

Mr. Wadhams has hitherto been manager of the large Bayonne refinery of this company and has for years been in direct charge of the manufacture of all of the company's products, and through this experience is fitted to an unusual degree for the new work which he is to undertake.

Standard British Trade Definitions

Adopted by the BIRMINGHAM JEWELLERS' & SILVERSMITHS' ASSOCIATION (Rolled Gold, Gilt and Imitation Jewelry Manufacturers' Trade Section), 27 Frederick Street, Birmingham, England.

GOLD FRONTED

Goods the fronts of which are made from a sheet of gold, which can be separated (by running the solder where necessary), and the front portion is then all gold.

ROLLED GOLD
GOLD PLATE
ROLLED GOLD PLATE

A sheet of gold sweated or soldered to a thicker sheet or bar of base metal, and the whole rolled down together.

In the case of wire the definition shall be that of the whole of the bar of base metal is surrounded with gold, sweated or soldered on, and the whole drawn down together. This is known in the Optical Trade as 'Gold Filled."

The test recommended is that the goods if annealed and pickled will show a surface of gold.

The same definition applies to all these terms, but the term "Rolled Gold" is recommended.

GOLD FILLED

A term chiefly used by the makers of spectacle frames and other optical goods, and watch cases, and should be confined to the manufacture of these and similar goods, such as cigarette cases, sovereign purses, etc.

A sheet of base metal covered both sides with sheets of gold sweated or soldered on.

In the case of wire the same definition applies as that of rolled gold wire.

GOLD SHELL

An article of base metal completely cased in gold by any process, so that if cut through (so as to expose the base metal) and immersed in acid until all the base metal is dissolved, a shell of gold is left.

GOLD CASED

An electro-deposit of gold on base metal which must stand the pure nitric-acid test.

GILT

A deposit of gold on base metal by chemical or electro-deposition process.

FIRE GILT OR MERCURIAL GILT

Articles covered with gold dissolved in mercury which are put into the fire to burn out the mercury.

It must be clearly understood that the whole of the foregoing terms apply **only** to goods the **base metals** in which are non-ferrous. Where any ferrous metals are used, it must be distinctly stated in description, such as "Gilt on Iron." No other terms than those defined above should be used.

Imported articles corresponding with any or all of the foregoing descriptions, offered for sale should be made to comply in all respects with these descriptions.

These Standard Trade Definitions have been approved and adopted by:

The Birmingham Jewellers' and Silversmiths' Association.

The London Wholesale Jewellers' and Allied Trades' Association.

The National Association of Goldsmiths.

ZINC MEMORIAL TABLET

On February 16, 1922, the secretary of the Zinc Institute was present at the unveiling of a handsome tablet in honor of employees of the New Jersey Zinc Company, and its subsidiaries, who

ZINC MEMORIAL TABLET

served their country during the World War and in memory of those employees who made the supreme sacrifice.

Interest is attached from the fact that the tablet was made of zinc. It reflects a new potential use for zinc.

But the greatest importance is attached to the spirit of the organization back of the recent unveiling. The tablet was erected by the Horse Head Club, an organization of employees in the New York office of the New Jersey Zinc Company. It functions as a well oiled piece of machinery in effecting the closest co-operation among its members.

GOVERNMENT PUBLICATIONS

Quicksilver in 1921.—U. S. Geological Survey, Washington, D. C.

Production of Bauxite in 1921.—U. S. Geological Survey, Washington, D. C.

Secondary Metals in 1920.—By J. P. Dunlop, U. S. Geological Survey, Washington, D. C.

Zinc in 1920.—By C. E. Siebenthal and A. Stoll, U. S. Geological Survey, Washington, D. C.

Manganese and Manganiferous Ores in 1920.—By H. A. C. Jenison, U. S. Geological Survey, Washington, D. C.

Cobalt, Molybdenum, Nickel, Tantalum, Titanium, Tungsten, Radium Uranium, and Vanadium in 1920.—By Frank L. Hess, U. S. Geological Survey, Washington, D. C.

The Fluorspar Industry in 1921.—U. S. Geological Survey, Washington, D. C.

Cadmium in 1921.—U. S. Geological Survey, Washington, D. C.

Rolled Zinc in 1921.—U. S. Geological Survey, Washington, D. C.

Tin in 1919.—By Adolph Knopf and Bertrand L. Johnson, U. S. Geological Survey, Washington, D. C.

Zinc Produced in the United States, 1918-1921.—U. S. Geological Survey, Washington, D. C.

TECHNICAL PUBLICATIONS

Cutting Fluids, published by the Bureau of Standards as Technologic Paper No. 204.

Cutting fluids are used both to cool and lubricate. When lubrication is the more important, it is generally recognized that fatty oils are superior to mineral oils, although the reason has never been clearly explained. The evidence appears to be that the value of fatty oils is due to their acidity which causes the adhesion to metal to be greater than is the case with mineral oils. If this should prove to be the case it may yet be possible to synthetize an oil which has all of the virtues of lard oil without its obvious defects.

PHOSPHOR-COPPER AND COPPER-LEAD

General contact is maintained by the Ithaca, New York, field office of the Bureau of Mines with the metallurgy of non-ferrous alloys in general and copper alloys in particular. Plans have been made for experimental study of two problems as soon as the other work in progress will allow.

(a) Study of the preparation of phosphor copper by electric smelting direct from phosphate rock. Phosphor copper is an essential material in the production of many high grade bronzes, and is made from elemental phosphorus by different methods, in which there may be loss of phosphorus, danger of fire and of phosphorus poisoning. Besides the possibility of a cheaper method of producing phosphor copper, a study of its preparation by electric smelting should throw light on some problems in the theory of the reduction of phosphatic ores.

(b) The Bureau of Mines is continually in receipt of requests for information in regard to the preparation of such alloys as that of 50 per cent copper 50 per cent lead. On account of the apparent need for information on melting and casting technique and because it is quite possible that present methods might be improved, a study of the problem is planned.

The electric melting of brass has been studied by the Bureau of Mines for the past ten years, from the points of view of decreasing the losses of the constituent metals in brass, especially zinc, improvement in labor conditions, aiding in the conservation of fuel oil by substituting electric heat generated by water power or by coal, improving the quality of the brass and decreasing the cost of melting. In the course of the work a furnace type was developed by the Bureau which has found wide use in the industry, both in foundries and rolling mills, more than half of the electric brass furnace kilowattage of the country being connected to furnaces of this type. The Bureau has kept in close touch with makers and users of all other types of electric brass furnaces as well, and a comprehensive bulletin on the design, operation and commercial performance of all the furnaces is awaiting publication. Close contact will be maintained with this problem, but unless developments call for it, no active laboratory work is contemplated because electric melting has already become well established in the brass industry. Contact will also be maintained with developments in the use of electric furnaces for melting aluminum and other non-ferrous metals and alloys and, to a certain extent, with their use for melting gray iron, since some of the furnaces primarily designed for brass melting, including that designed by the Bureau of Mines, are to be tried out in such work.

ABRASIVE WHEEL SAFETY CODE

Under the joint sponsorship of the Grinding Wheel Manufacturers Association of the United States and Canada and the International Association of Industrial Accident Boards and Commissions, there was organized a sectional committee for formulating a safety code for abrasive wheels. The code prepared by this committee and approved by the sponsors has been approved as Tentative American Standard by the American Engineering Standards Committee.

The code contains rules and specifications considered necessary to insure safety in the use of abrasive wheels operating at speeds in excess of 2,000 surface feet per minute. It consists of sections dealing with scope, types of protection devices, storage and inspection of wheels, general machine requirements, protection hoods, work rests, protection of wheels, flanges, mountings, speeds, operating rules and general data. It is well illustrated.

Copies of the code may be secured from the American Engineering Standards Committee, 29 West 39th street, New York City. Price 10 cents each.

TRADE PUBLICATIONS

National-Chapman and Universal-Chapman Lift Trucks.—A folder issued by the Revolvator Company, 336 Garfield avenue, Jersey City, N. J., describing and illustrating the hand-propelled Universal-Chapman Lift Truck for use in warehouses and factories.

Price List No. 5 On Gas Burning Equipment.—Issued by the Improved Appliance Company, 413 Kent avenue, Brooklyn, N. Y., in two parts, part 1 covering industrial appliances, part 2, industrial burners; and which supersedes their price list No. 4.

Metal Cyanide Plating Solutions.—A booklet issued by the Hanson and Van Winkle Company, Newark, N. J., describing and giving the formulae of metal cyanide plating solutions of various metals.

The Art of Lacquering.—A booklet issued by the Egyptian Lacquer Manufacturing Company, 5 East 40th street, New York, which has, as its purpose, the outlining of the most important steps necessary for the proper application of lacquers and lacquer enamels.

Audel's Engineers' and Mechanics' Guides.—A booklet issued by Theo. Audel and Company, 72 Fifth avenue, New York, describing and illustrating their set of reference books on engineering and mechanical subjects.

Bridgeport No. 16, Bridgeport Crown No. 77, and Bridgeport Ace, Tire Pumps.—Three folders issued by the Bridgeport Brass Company, Bridgeport, Conn., illustrating and describing these three specialties which they manufacture.

Electroplating & Polishing Supplies.—Catalog No. 22 issued by Hanson & Van Winkle Company, Newark, N. J. It is an excellent catalog, profusely illustrated, completely detailed and covers the whole line of plating and polishing supplies.

Perpetual Inventory or Stores Control.—A treatise issued by the Chamber of Commerce of the U. S., Washington, D. C., which gives details of a method of eliminating the annual taking of inventory.

Conical Ball Mill.—An illustrated folder issued by the Hardinge Company, New York, giving details of installations of Hardinge mills.

Ledrite Brass Rod.—A folder issued by the Bridgeport Brass Company, Bridgeport, Conn., describing and illustrating chamfered Ledrite rod.

List of Designs for Rolling Mill Equipment.—Issued by the Sundh Engineering and Machine Company, 1105 Frankford avenue, Philadelphia, Pa., listing the various Sundh rolling mill and other machines.

Motors and Motor Generators.—Two folders issued by the Jantz and Leist Electric Company, Cincinnati, Ohio, illustrating their motors and motor generators sets.

Consumption of Copper and Its Varied Uses.—A booklet written by H. D. Hawks, E. E., published by Cameron, Michel & Co., Inc., 8 West 40th street, New York, setting forth in detail and with tables the consumption and uses of copper in its various phases.

Book of Views. Gunite Book No. 7.—A booklet issued by the Gement Gun Construction Company, Chicago, Ill., illustrating with photographs construction work in process of being done by their Cement-Gun method, and which has been completed during the past two years.

D. F. C. Oil Burners.—A catalogue issued by the Denver Fire Clay Company, Denver, Colo., setting forth principles of the proper use of oil fuels, and illustrating and describing their various burner appliances.

Brass Rod and Peas.—Another folder issued by the Bridgeport Brass Company, Bridgeport, Conn., setting forth the merits of Ledrite Brass Rod.

Education and Fuel Conservation.—A folder issued by the Hays School of Combustion, 1412 S. Michigan avenue, Chicago, Ill., which is giving a course in fuel and combustion engineering.

Portable Electric Drills.—A small catalogue issued by the Black and Decker Manufacturing Company, Baltimore, Md., describing and illustrating their portable electric drills, grinders and other tools.

Research Narratives, No. 28. A Serbian Herdsman's Contribution to Telephony.—A folder issued by the Engineering Foundation, 20 West 39th street, New York.

General Circular of the Bengal Institute of Arts and

Sciences, Tamluk, Dist. Midnapur, Bengal, India.—A booklet issued by this Institute describing its efforts to spread education in the arts, sciences and technology among the people of India, being accompanied by an appeal for publications applicable to its work.

Worth Looking Into.—A catalogue of 672 pages, on platers' and jewelers' supplies published by William Dixon, Inc., Newark, N. J. It illustrates and describes their large and varied stock, and the articles are so compiled and classified as to make ordering easy. In addition it is replete with technical information, compounds, tables, etc., which will appeal to the workman in the solution of practical problems. The company, to supplement this service, encourages correspondence on technical difficulties.

Surface Combustion Low Pressure Air-Gas Inspirators.—Bulletin No. 3 D, issued by the Surface Combustion Company, 366-368 Gerard avenue, New York, describing these inspirators which are readily applicable to any make of gas furnace.

Price Chart of All Commodities, 1860-1922.—A chart compiled and published by the Dwight P. Robinson Company, 125 East 46th street, New York, engineers, which compares the rise and fall in prices throughout the years mentioned, and emphasizes the similarity in price movements during the two great war periods. It is based on data gathered by the Department of Labor, which was studied out and worked up by the President's Conference Committee of the railroads.

Chemical Engineering Catalogue.—The sixth annual edition of a standard work of reference for chemical engineers, works managers, purchasing agents and operating engineers, published by the Chemical Catalog Company, Inc., New York. It is a compilation of condensed catalogue data of manufacturers supplying this field, supplemented by a General Classified Directory of equipment, supplies and materials. It also includes a Technical and Scientific Book Section, cataloging and briefly describing books in English on Chemical and Related Subjects. It is stated that the purpose of this book is to **inform** the market for chemical equipment rather than to advertise to it.

The method of distribution is interesting. The book is leased for $2 a copy for 1 year to engineers, managers, superintendents, chief chemists, heads of chemical departments in colleges and technical schools, and libraries. To others a charge of $10 is made. It is 9" x 12" in size and has about 1300 pages.

The section on books is a decided innovation and a worthwhile one. The volume should form a part of every business and technical library.

Bulletin of the National Research Council, Washington, D. C. A paper-bound volume of 140 pages, giving the research laboratories in industrial establishments of the United States, including consulting laboratories; originally compiled by Alfred D. Flinn, Secretary, Engineering Foundation, and revised and enlarged by Ruth Cobb, Research Information Service. Of special interest to those in the metal field is the section on non-ferrous metals (page 114) and the details of these laboratories and their operating staffs, placed alphabetically in the book.

METAL STOCK MARKET QUOTATIONS

	Par	Bid	Asked
Aluminum Company of America	$100	$350	$400
American Hardware Corp.	100	154	156
Bristol Brass	25	15	18
International Nickel, com.	25	15½	16
International Nickel, pfd.	100	72	74
International Silver, com.	100	20	40
International Silver, pfd.	100	92	95
New Jersey Zinc	100	144	147
Rome Brass & Copper	100	125	...
Scoville Mfg. Co.	100	315	330
Yale & Towne Mfg. Co.	...	285	295

Corrected by J. K. Rice, Jr., & Co., 36 Wall Street, New York.

Metal Consumption Statistics

ESTIMATED CONSUMPTION OF COPPER IN THE UNITED STATES*

	1919		1920	
	Pounds	Per Cent	Pounds	Per Cent.
Electrical manufactures	284,000,000	23.48	340,000,000	26.12
Telephones and telegraph	65,679,218	5.43	100,000,000	7.68
Wire (not included elsewhere)	160,000,000	13.23	190,000,000	14.59
Automobiles	92,965,000	7.68	99,320,400	7.63
Locomotives	8,998,000	0.74	9,457,250	0.73
Railway cars—freight	15,676,400	1.30	7,543,500	0.58
Railway cars—passenger	156,400	0.01	576,000	0.04
Steam railways—electrified	250,000	0.02	2,200,000	0.17
Shipbuilding	101,884,625	8.42	61,906,325	4.76
Buildings	76,778,800	6.35	53,443,200	4.10
Ammunition	23,000,000	1.90	23,400,000	1.80
Fire extinguishers	2,000,000	0.16	2,100,000	0.16
Pins	2,000,000	0.16	2,000,000	0.15
Valves	10,000,000	0.83	10,000,000	0.77
Coins	2,075,321	0.17	3,148,863	0.24
Bearing metal—steam railways	45,000,000	3.72	45,000,000	3.46
Cash registers	1,300,000	0.11	1,340,000	0.10
Condensers	10,000,000	0.83	6,000,000	0.46
Miscellaneous	150,000,000	12.40	180,000,000	13.83
Total	1,051,763,764	86.94	1,137,435,538	87.37
Exported in manufactures	157,965,641	13.06	164,420,412	12.63
Total in manufactures	1,209,729,405	100.00	1,301,855,950	100.00

* From Present and Future of the Copper Industry, by Cornelius F. Kelley, President Anaconda Copper Mining Company. Mining and Metallurgy, February, 1922.

On January 1, 1919, the stock of copper, according to the best available statistics, assumed the unprecedented total of 2,278,812,300 pounds, made up as follows:

COPPER STOCKS, 1919*

	Pounds
Producers	
Crude	340,314,000
Process	319,196,000
Refined	180,000,000
Total	839,510,000
Governments	
United States	128,714,200
Great Britain	179,200,000
France	168,000,000
Italy	67,200,000
Germany	67,200,000
Japan	20,160,000
Total	630,474,200
Scrap, in Brass, etc.	
United States	92,028,100
Great Britain	369,600,000
France	224,000,000
Italy	44,800,000
Germany	67,200,000
Japan	11,200,000
Total	808,828,100

to which amount, in order to bring the situation to the beginning of 1921, there should be added the production of 1919 and 1920, respectively, as follows:

	1919	1920
United States	1,310,972,580	1,343,945,000
Others	809,909,940	813,893,230
Total	2,120,882,520	2,157,838,230

The stocks on hand Jan. 1, 1921, have been estimated at 1,764,632,540 pounds, made up as follows:

COPPER STOCKS, 1921

	Pounds
Producers	
Crude	300,550,000
Process	229,002,000
Refined	641,474,000
Total	1,171,026,000
Governments	
United States	14,158,520
Great Britain	26,087,040
France	12,658,240
Italy	58,240,000
Japan	73,136,000
Total	184,279,800
Scrap, in Brass, etc.	
United States	10,606,740
Great Britain	302,400,000
France	67,200,000
Italy	29,120,000
Total	409,326,740

CONSUMPTION OF TIN IN UNITED STATES

USES, TONS OF 2,240 LBS. EACH *

Tin and terne plate	27,600
Solder	17,000
Babbitt and other bearing metals	10,800
Brass and bronze	4,800
Collapsible tubes	2,100
Foil	4,000
White metals	1,750
Tinning and retinning	1,900
Chemicals	1,700
Plated ware, britannia ware	1,000
Miscellaneous	3,607
Total	76,257

* From statistics gathered by the War Industries Board, Washington, D. C., during the war.

TIN AND TERNE PLATE OUTPUT

	CORPORATION	INDEPENDENTS	TIN CONSUMED
1912	581,346	381,625	16,800
1913	483,002	340,717	14,400
1914	498,863	432,378	16,300
1915	569,879	486,057	18,500
1916	620,732	614,268	21,600
1917	735,571	776,575	26,500
1918	711,985	761,954	25,800
1919	557,468	593,430	20,100
1920	648,148	788,538	25,100
1921	*900,000		15,700

AMERICAN DELIVERIES OF FOREIGN TIN †

	DELIVERIES OF FOREIGN TIN.	AMERICAN OUTPUT	SECONDARY TIN	TOTAL SUPPLY	TOTAL CONSUMPTION*
1917	57,881	4,849	17,300	80,000	77,000
1918	58,027	9,854	21,300	79,100	75,000
1919	32,301	11,596	21,400	65,300	68,000
1920	51,120	14,513	21,000	86,600	80,000
1921	25,918	8,781	18,000*	52,700	60,000

*Estimated.
† From the New York Metal Exchange.

MARCH MOVEMENT IN METALS

	Highest	Lowest	Average
Copper:			
Lake	13.25	12.75	13.033
Electrolytic	13.00	12.50	12.835
Casting	12.62½	12.25	12.538
Tin	29.75	28.75	29.174
Lead, f. o. b. St. Louis	4.60	4.40	4.426
Zinc (brass special)	4.80	4.65	4.745
Antimony	4.50	4.15	4.249
Aluminum	18.50	16.50	17.522
Quicksilver (per flask)	$51	$49	$50.326
Silver (cts. per oz.) foreign	66.12½	63	64.380

WATERBURY AVERAGE

Lake Copper—Average for 1920, 13.136.—January, 1922, 13.875.—February, 13.375—March, 13.125.

Brass Mill Zinc—Average for 1920, 5.175—January, 1922, 5.25.—February, 5.00.—March, 5.10.

Metal Prices, April 3, 1922

NEW METALS

Open Market

COPPER—DUTY FREE. PLATE, BAR, INGOT AND OLD COPPER.
Manufactured 6 per centum. Cents
Electrolytic, carload lots, delivered 12.62½c.
Lake, carload lots, delivered 12.75c.
Casting, carload lots, f. o. b. refinery 12.25c.

TIN—Duty free.
Straits, carload lots 29⅜c.

LEAD—Duty, Pig, Bars and Old, 25%; pipe and sheets, 20%. Pig, carload lots 4.85-4.90

ZINC—Duty 15%.
Brass Special 4.80
Prime, Western, carload lots 4.70

ALUMINUM—Duty, Crude, 2c. per lb. Bales, sheets, bars and rods, 3½c. per lb.
Small lots, f. o. b. factory .....
100-lb. f. o. b. factory .....
Ton lots, f. o. b. factory 17.50-20.10

ANTIMONY—Duty 10%.
Cookson's Hallet's or American Nominal
Chinese, Japanese, Wah Chang WCC, brand spot 4.50

NICKEL—Duty, Ingot, 10% ad valorem. Sheet, strip, atrip and wire, 20%.
Ingot 36.00
Spot 36.00
Electrolytic 31½-39

MANGANESE METAL—95-98% Mn., carbon free, per lb. Mn. contained. Nominal 0.75

MAGNESIUM METAL—Duty 20% ad valorem (100 lb. lots) $1.25-1.35

BISMUTH—Duty free 2.00-2.10

CADMIUM—Duty free 1.00-1.25

CHROMIUM METAL—95-98% Cr., per lb. Cr. contained. Nominal 1.50

COBALT—97% pure 3.00-3.25

QUICKSILVER—Duty 10% per flask of 75 lbs. $49-$50

PLATINUM—Duty free, per ounce $85-90

SILVER—Government assay—Duty free, per ounce .99⅛

GOLD—Duty free, per ounce 20.67

Metal Prices, April 3, 1922

INGOT METALS

Silicon Copper, 10%	according	to	quantity	34 to38
Phosphor Copper, guaranteed 15%	"	"	"	19 to29
Phosphor Copper, guaranteed 10%	"	"	"	18½to28½
Manganese Copper, 30%	"	"	"	50 to56
Phosphor Tin, guarantee 5%	"	"	"	35⅝to45⅝
Phosphor Tin, no guarantee	"	"	"	41¾to51
Brass Ingot, Yellow	"	"	"	8¼to10½
Brass Ingots, Red	"	"	"	11¼to13
Bronge Ingot	"	"	"	11½to13¼
Parsons Manganese Bronze Ingots	"	"	"	16½to18
Manganese Bronze Castings	"	"	"	21 to33
Manganest Bronze Ingots	"	"	"	11½to15
Manganese Bronze Forgings	"	"	"	30 to40
Phosphor Bronze	"	"	"	24 to30
Casting Aluminum Alloys	"	"	"	18 to21
Monel Metal	"	"	"	38

OLD METALS

Buying Prices		Selling Prices
10 to10½	Heavy Cut Copper	11¾to12
9¾to10¼	Copper Wire	11½to11¾
8½to 9	Light Copper	10 to10½
8 to 8½	Heavy Machine Comp.	9¼to 9¾
5¾to 6¼	Heavy Brass	8 to 8½
4½to 5	Light Brass	6 to 6½
5¼to 5½	No. 1 Yellow Brass Turnings	6¼to 6¾
7 to 7½	No. 1 Comp. Turnings	8½to 9
4	Heavy Lead	4½
4	Zinc Scrap	4½
5 to 5½	Scrap Aluminum, Turnings	7 to 8
10½to11½	Scrap Aluminum, cast alloyed	12½to13½
13½to14½	Scrap Aluminum, sheet (new)	15½to16½
18½	No. 1 Pewter	22½
15	Old Nickel anodes	17
23 to25	Old Nickel	27 to29

BRASS MATERIAL—MILL SHIPMENTS

In effect Feb. 17, 1922

To customers who buy 5,000 lbs. or more in one order.

	Net base per lb.		
	High Brass.	Low Brass.	Bronze.
Sheet	$0.16¼	$0.17¾	$0.19¼
Wire	0.16¾	0.18¼	0.19¾
Rod	0.14¼	0.18¾	0.20¼
Brazed tubing	0.23	.....	0.28
Open seam tubing	0.23	.....	0.28
Angles and channels	0.25	.....	0.30

To customers who buy less than 5,000 lbs. in one order.

	Net base per lb.		
	High Brass.	Low Brass.	Bronze.
Sheet	$0.17¼	$0.18¾	$0.20¼
Wire	0.17¾	0.19¼	0.20¾
Rod	0.15¼	0.19¾	0.21¼
Brazed tubing	0.24	.....	0.29
Open seam tubing	0.24	.....	0.29
Angles and channels	0.26	.....	0.31

SEAMLESS TUBING

Brass, 18c. to 19c. per lb. base.

Copper, 20¾c. to 21¾c. per lb. base.

TOBIN BRONZE AND MUNTZ METAL

Tobin, Bronze Rod	18¼c.	net base
Muntz or Yellow Metal Sheathing (14"x48")	16¼c.	" "
Muntz or Yellow Rectangular Sheets other than Sheathing	17¼c.	" "
Muntz or Yellow Metal Rod	14¼c.	" "

Above are for 100 lbs. or more in one order.

COPPER SHEET

Mill shipments (hot rolled)	20¼c.-21¼c. net base
From stock	21¼c.-22¼c. net base

BARE COPPER WIRE—CARLOAD LOTS

14¾c. to 15c. per lb. base.

SOLDERING COPPERS

300 lbs. and over in one order	18½c. per lb. base
100 lbs. to 200 lbs. in one order	19c. per lb. base

ZINC SHEET

Duty, sheet, 15%. Cents per lb.

Carload lots, standard sizes and gauges, at mill, 7½c. basis less 8 per cent. discount.

Casks, jobbers' prices	8½c. to 9c.
Open casks, jobbers' prices	9½c. to 10c.

ALUMINUM SHEET AND COIL

Aluminum sheet, 18 ga. and heavier, base price	32c.
Aluminum coils, 24 ga. and heavier, base price	30c.

NICKEL SILVER (NICKELENE)

Base Prices

Gra le "A" Nickel Silver Sheet Metal

10% Quality	24¼c.	per lb.
15% "	26 c.	" "
18% "	26¾c.	" "

Nickel Silver Wire and Rod

10% "	27¼c.	" "
15% "	31¼c.	" "
18% "	34 c.	" "

MONEL METAL

Shot	32
Blocks	32
Sheet Bars	40
Hot Rolled Rods (base)	40
Cold Drawn Rods (base)	50
Hot Rolled Sheets (base)	45

BLOCK TIN SHEET AND BRITANNIA METAL

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more, 10c. over Pig Tin. 40 to 100 lbs., 15c over 25 to 50 lbs., 17c. over, less than 35 lbs., 25c. over.

No. 1 Britannia—18" wide or less. No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 8c. over N. Y. tin price; 100 lbs. or more, 10c. over Pig Tin. 50 to 100 lbs., 15c. over, 25 to 50 lbs., 20c. over, less than 25 lbs., 25s. over. Above prices f. o. b. mill.

Lead Foil—base price—figured on base price of lead at the time.

Platers' metal, so called, is very thin metal not made by the larger mills and for which prices are quoted on application to the manufacturer.

SILVER SHEET

Rolled silver anodes .999 fine are quoted at from 68½c. to 71½c. per Troy ounce, depending upon quantity.

Rolled sterling silver, 66c. to 69c.

NICKEL ANODES

85 to 87% purity	.40c.	per lb.
90 to 92% "	.42½c.	per lb.
95 to 97% "	.45c.	per lb.

Supply Prices, April 3, 1922

CHEMICALS

In Commercial Quantities—New York Prices

Acid—		
Boric (Boracic) Crystals	lb.	.14
Hydrochloric (Muriatic) Tech., 20 deg., Carboys	lb.	.02½
Hydrochloric, C. P., 20 deg., Carboys	lb.	.08
Hydrofluoric, 30%, bbls	lb.	.07
Nitric, 36 deg. Carboys	lb.	.07
Nitric, 42 deg. Carboys	lb.	.07¼
Sulphuric, 66 deg., Carboys	lb.	.02½
Alcohol—		
Butyl	lb.	20-25c.
Denatured in bbls.	gal.	.36
Alum—		
Lump, Barrels	lb.	.04
Powdered, Barrels	lb.	.05
Aluminum sulphate, commercial tech	lb.	.02½-.03
Aluminum chloride solution	lb.	.20
Ammonium—		
Sulphate, tech., Barrels	lb.	.04
Sulphocyanide	lb.	.50
Argols, white, see Cream of Tartar	lb.	.27
Arsenic, white, Kegs	lb.	.07½
Asphaltum	lb.	.35
Benzol, pure	gal.	.45
Blue Vitrol, see Copper Sulphate.		
Borax Crystals (Sodium Biborate), Barrels	lb.	.05½
Calcium Carbonate (Precipitated Chalk)	lb.	.05
Carbon Bisulphide, Drums	lb.	.07½
Chrome Green	lb.	.36
Cobalt Chloride	lb.	—
Copper—		
Acetate	lb.	.48
Carbonate, Barrels	lb.	.19
Cyanide	lb.	.58
Sulphate, Barrels	lb.	.05¾
Copperas (Iron Sulphate, bbl.)	lb.	.02½
Corrosive Sublimate, see Mercury Bichloride.		
Cream of Tartar, Crystals (Potassium bitartrate)	lb.	.27
Crocus	lb.	.15
Dextrin	lb.	.05-.08
Emery Flour	lb.	.06
Flint, powdered	ton.	$30.00
Fluor-spar (Calcic fluoride)	ton	$75.00
Fusel Oil	gal.	3.00
Gold Chloride	oz.	14.00
Gum—		
Sandarac	lb.	.30
Shellac	lb.	—
Iron, Sulphate, see Copperas, bbl.	lb.	.02½
Lead Acetate (Sugar of Lead)	lb.	.12-.13
Yellow Oxide (Litharge)	lb.	.09
Mercury Bichloride (Corrosive Sublimate)	lb.	.86
Nickel—		
Carbonate Dry	lb.	.40
Chloride, 100 lb. lots	lb.	.30-.40
Salts, single, bbls	lb.	.11
Salts, double, bbl.	lb.	.11
Paraffin	lb.	.07-.10
Phosphorus—Duty free, according to quantity		.25-.30
Potash, Caustic, Electrolytic 88-92% fused, drums	lb.	6½
Electrolytic, 70-75% fused	lb.	.10
Potassium Bichromate, casks	lb.	.11
Carbonate, 80-85%, casks	lb.	.05
Cyanide, 165 lb. cases, 94-96%	lb.	.42½
Pumice, ground, bbls	lb.	.03
Quartz, powdered	ton.	$30.00
Official	oz.	—
Rosin, bbls.	lb.	.03½
Rouge, nickel, 100 lb. lots	lb.	.20
Silver and Gold	lb.	.60
Sal Ammoniac (Ammonium Chloride) in casks	lb.	.07½
Silver Chloride, dry	oz.	.86
Cyanide	oz.	—
Nitrate, 100 ounce lots	oz.	.44
Soda Ash, 58%, bbls	lb.	.03
Sodium—		
Biborate, see Borax (Powdered), bbls	lb.	.05½
Bisulphate, tech., bbls	lb.	.03½
Cyanide, 96 to 98%, 100 lbs	lb.	.25
Hydrate (Caustic Soda) bbls	lb.	.04½
Hyposulphite, kegs	lb.	.04
Nitrate, tech. bbls	lb.	.04
Phosphate, tech., bbls.	lb.	.03¾
Silicate (Water Glass) bbls	lb.	2½
Sulpho Cyanide	lb.	.45
Soot, Calcined	lb.	—
Sugar of Lead, see Lead Acetate	lb.	.12-.13
Sulphur (Brimstone) bbls	lb.	.03
Tin Chloride	lb.	.31
Tripoli	lb.	.03½
Verdigris, see Copper Acetate	lb.	.48
Water Glass, see Sodium Silicate, bbls	lb.	.02½
Wax—		
Bees, white ref. bleached	lb.	.55
Yellow, No. 1	lb.	.22
Whiting, Bolted	lb.	.02½-.06
Zinc, Carbonate, bbls	lb.	.14-.18
Chloride, 600 lb. lots	lb.	.06½
Cyanide	lb.	.42
Sulphate, bbls.	lb.	.03½

COTTON BUFFS

Open buffs, per 100 sections (nominal).

12 inch, 20 ply, 64/68, cloth	base,	$33.80
14 " 20 " 64/68, "	"	42.05
12 " 20 " 84/92, "	"	42.55
14 " 20 " 84/92, "	"	57.35
Sewed Buffs, per pound		
Bleached and unbleached	"	.50

FELT WHEELS

			Price Per Lb. Less Than 100 Lbs.	100 to 300 Lbs.	300 Lbs. and Over
Diameter—10" to 16"	1" to 3"		2.60	2.50	2.35
" 6", 8" and over 16"	1" to 3"		2.70	2.60	2.45
" 6" to 24"	Over 3"		3.00	2.90	2.75
" 6" to 24"	½" to 1"		3.60	3.50	3.35
" 4" to 6"	¼" to 3"		4.60	Any quantity	
" Under 4"	¼" to 3"		5.20	Any quantity	

Grey Mexican or French Grey—10c. less per lb. than Spanish, above. Odd sizes 50c advance.